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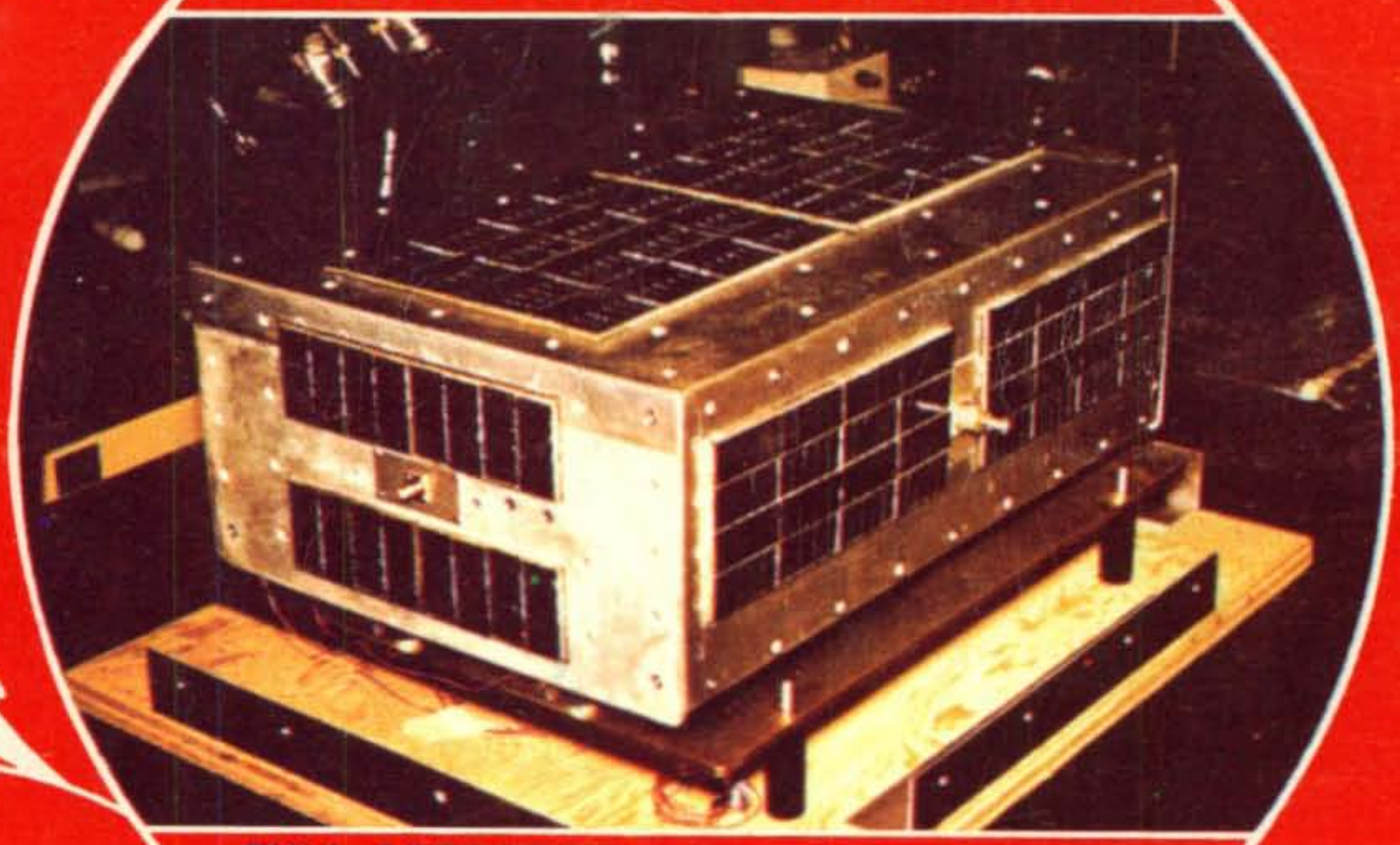

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The Radio Amateur's Journal

08240

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DECEMBER, 1972 VOL. 28, NO. 12

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The Radio Amateur's Journal

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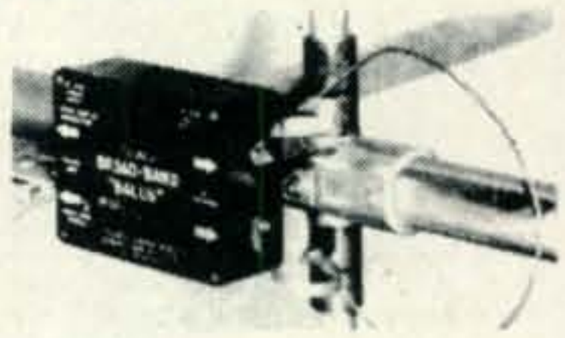

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ZERO BIAS

On September 25, a Bill was introduced n the House of Representatives by Congressman Teague of California which is of specific nterest to all amateurs. The Bill, H.R. 16916, proposes to amend section 303(s) of the Communications Act of 1934 by the addition of a paragraph reading: [The Commission shall] "Have authority to require that apparatus designed to receive broadcasts comply with standards of the Commission under this paragraph ... when such apparatus is shipped in interstate commerce, or is imported from any foreign country into the United States, for sale or resale to the public. Standards under this paragraph shall be prescribed by rule for the purpose of requiring the filtering out of interference. Such standards shall include a requirement that *all interference from any amateur station operation on its assigned frequency be filtered out.*" (Italics are ours.)

It would be too optimistic to believe that this measure could pass without a bitter fight by commercial TV set manufacturers and importers. However, we see no danger to amateur radio stemming from public discussion of inter-service interference problems. For this reason, we urge that amateurs make their own Representatives aware of the existence of H.R. 16916, and, through the pressure that only a voter can bring to bear, help the Bill see the light of debate.

November's Cover

In the excitement of the launch of OSCAR 5 in October and our eagerness to include a brief launch announcement in the November issue, we were forced to omit a brief paragraph acknowledging the people who supplied the raw material for the November cover. In retrospect, our printer did a marvelous job of butchering some fine photos, and perhaps our contributors would prefer to go unnamed, hi! But we do want to credit Bill DeWitt, W2DD, for some more fine color photography he was responsible for the outstanding photo work on the September *CQ*-Color SSTV-cover, as well as the article in that issue describing a simple technique for duplicating his work). Bill is an avid color photographer, SSTVer, and earns his daily bread in Photographic Technology for Eastman Kodak.

The subject matter for W2DD's photos on November's cover was graciously provided by the Antique Wireless Association's secretary Bruce Kelly, W2ICE. The museum is located in Holcomb, New York and is a treasure-trove of early wireless equipment and memorabilia, and is open by appointment. Interested amateurs contemplating a trip through upstate New York would do well to telephone Bruce in advance to determine if it will be convenient to visit the AWA Museum. Holcomb is about 25 miles southeast of Rochester.

Another Year

As we wind up another year of publication (our 28th) it's fitting that we thank the many people who have continued to make *CQ* possible. First, of course, are tens of thousands of readers whose enthusiasm for our product helps keep our own enthusiasm high. Feedback from readers is what sets the mood of any magazine and the fact that the mood of *CQ* is usually one of quiet enthusiasm for all aspects of this fine hobby is simply a reflection of that same mood in our readers.

Our thanks, also, to the advertisers who, month after month demonstrate their belief that *CQ*'s readers are the most active (and thus the most desireable) magazine audience in amateur radio. Without the heavy advertising support we enjoy it would be difficult, if not impossible, to continue to publish.

And a very special thank you to the growing family of *CQ* staffers who tirelessly labor to bring you the most timely, informative and accurate special interest columns published anywhere in amateur radio, the world's largest and best DX Contest, and the hobby's most highly regarded operating achievement awards programs. Contrary to what has been maliciously implied elsewhere, of the fourteen licensed amateurs on our staff, twelve are very active on bands from 160m. through 220 mHz; one will soon return to the air (antenna weather permitting), and only one is totally inactive. Not a bad cross-section, we think.

So, from the in-office staff: Bill Travis and Joe Piraino - Artists; Gloria - Circulation; Dick Cowan and Jack Schneider - Advertising; Al, Managing Editor; Sue, Editorial Assistant; and I, we wish you all a very happy holiday season.

73, Dick, K2MGA

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OUR READERS SAY

Novice Bands for the Novices

Editor, *CQ:*

Two months ago, I received my Novice license, and already I have found things wrong which irritate me very much.

One is the constant jamming of W1AW, which has already received valuable space in this column.

The other is the use of Novice bands for phone work. As anyone knows, these bands are plenty crowded already. The 40 meter band seems to be the worst. With QRP, crowded bands, and international broadcasting, it is no wonder many a Novice never goes on!

The use of Novice bands for phone, though, is senseless. There is plenty of room for the upper class licensees to work without using these bands. They must remember that their signal is twice the size of ours and can wipe out a 599 signal on c.w.!

This is a hobby founded on the advancement of radio principles, but a few are downgrading it for all. Reminds me of CB.

Dale. H. Cole, WN8NSF
St. Joseph, Michigan

Ham-M Improvements

Editor, *CQ:*

I would like to suggest an improvement on the technique outlined by Stu Meyer, W2GHK, in his article in June 1971 *CQ* concerning changing indications on the indicator box of the Ham-M rotor due to changing line voltage.

The d.c. voltage in the indicator circuit has a large a.c. ripple component due to insufficient filtering. When zener diodes are added to the circuit, they conduct only during the peak of each cycle. For this reason they do not provide the highly efficient regulation they are capable of although they do make a noticeable improvement over the original circuit.

I added a 500 mf 50 v.d.c. electrolytic capacitor directly across the zener diodes, and using a 20 volt zener there is no noticeable change in meter indication for any line voltage above 105. With a 20 volt zener, both the internal and external calibration pots are at the end of their range. The use of a lower voltage zener diode would regulate the circuit below 105 volts, but would require a resistor changes to get proper meter calibration.

One additional comment is that the zener diodes are shown backwards in the schematic in the article.

John E. Becker, K9WEH
Prospect Heights, Illinois

Is It Better To Receive?

Editor, *CQ:*

I would like to voice my opinions concerning the article, "It Is Better To Receive....," by Glenn Hauser [*CQ*, Sept. '72, p.41]. His excellently written article revives pleasant memories of my pre-Novice days when I would excitedly call the whole family in to hear HCJB or Radio Moscow that I had just tuned with a shaky hand on my ancient SW receiver.

I enjoyed those days. However, with a General ticket in my hot little hand, I can honestly say I enjoy myself much more now that I can talk to someone halfway around the world. Yes, and I am not ashamed to admit it, I am human. But, looking at it from a non-biased angle, which takes more skill: tuning a commercial broadcast station probably running upwards of a kilowatt to a huge antenna, or vying with a dozen or more stations, all on the same frequency trying to attract the attention of some DX station running low power with all home-constructed gear? I have sometimes sat listening patiently for hours waiting for the QRM to die down sufficiently for my QRP and lousy antenna to be heard through the pileup. All of this on 20 meter c.w. As is the case with every s.w.l. I know, I believe most s.w.l.'s have their sights set on a ham ticket. Probably the greatest majority of new hams entered the hobby via the s.w.l. route.

I did not intend this letter to belittle the ability of the s.w.l., nor do I mean any personal offense against Mr. Hauser. I merely wanted to offer a different viewpoint on these two similar hobbies. As hobbies, the important thing is that each individual does what is enjoyable to him. Mr. Hauser enjoys s.w.l.ing, and I enjoy ham radio. To each his own.

Steve Uhrig, WA3SWS
Ellicott City, Maryland

For Better DXing

Editor, *CQ:*

Mr. Hagen's comments in his column [DX, Sept. '72, p. 66] certainly bears repeating. I am referring to the irrational behavior near or on 14.195 mHz. I have been meaning for some time to express my views on this matter, and I have put it off long enough.

It seems that no matter what you do these days, whether you are a net control for a DX group or for an expedition you hear someone griping about something.

The usual comments are, "Why are you working

[*continued on page 84*]

Announcements

Special Apollo Flight Operation

The Goddard Amateur Radio Club announces that WG2SFC will be on the air from prior to launch (Dec. 16) until after splashdown. The days of this operation will slip if the launch slips.

A special QSL will confirm WG3SFC contacts (SASE requested). QSL to: Goddard ARC, P.O. Box 86, Greenbelt, MD 20770.

The following frequencies (+5kHz) will be used: **SSB** - 3950, 7275, 14325, 21400, 28650. **CW** - 3560, 7060, 14060, 21060, 28060.

Novice frequencies in each band will be tuned from time to time after suitable calls on the c.w. frequencies.

Stolen Equipment

A Tempo I was stolen from the office of John W. Richardt, W2WIY/W2GBR, in July. The serial number is 311094. If you have any information, please contact him.

Amateur FM Comes of Age

Henry Radio proudly announces the new Tempo line of amateu FM transceivers for the 146 and 220 MHz bands. The Commerci Line transceivers are so fine they can meet the tough FC requirements for Type Acceptance in commercial two-way servic A broad line of transceivers so modestly priced that any amateu can own one. Transceivers that defy comparison for bot performance and value. Transceivers that are not a dream f tomorrow but are available right now . . . toda

TEMPO'S "COMMERCIAL LINE" TRANSCEIVERS . . . THE BEST!

TEMPO/CL 220

As new as tomorrow! The Tempo Commercial Line VHF transceivers offer commercial performance at amateur prices. Both units include an audio limiter to assure constant deviation at all times and an instantaneous impulse squelch. Microphone, power cord, mounting bracket and one pair of crystals is included.

GENERAL SPECIFICATIONS:

- Frequency Range: 220-225 MHz (2 MHz operating range)
- Number of Channels: 12 channel capability for transmit and receive
- Microphone: Dynamic with coil cord
- Dimension: 2.36″ H x 5.90″ W x 7.66″ D
- Weight: 4.5 pounds
- Frequency Stability: ±0.001% (−20° to +60°)
- RF Power Output: 10 Watts or 3 Watts.
- Output Impedance: 50 ohms unbalanced.
- Sensitivity: 0.5 microvolts nominal for 20 db quieting.
- Spurious & Image Attenuation: 70 db below desired signal threshold sensitivity.
- Adjacent Channel Selectivity (15 KHz channels): 70 db attenuation of adjacent channels.
- Type of Receiver: Dual conversion superheterodyne.
- Audio Output: 2 Watts minimum w/internal speaker (at less than 10% distortion)
- The price: $329.00

TEMPO/CL 146

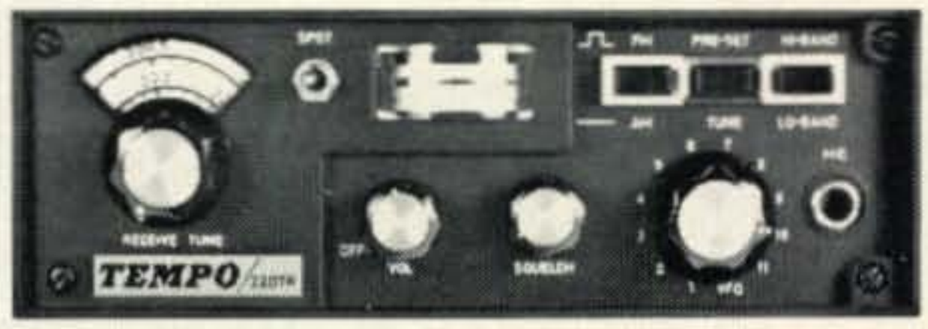
- Frequency Range: 146-148 MHz
- Same general specifications as CL 220
- The price: $279.00

THE TEMPO "VALUE LINE" . . . THERE'S NO BETTER BUY!

TEMPO/fmp

Truly mobile, the Tempo/fmp 3 watt portable gives amateurs 3 watts, or a battery saving ½ watt, FM talk power anyplace at anytime. With a leather carrying case included, this little transceiver will operate in the field, in a car, or at home with an accessory AC power supply. The battery pack is included. Frequency Range: 146-148 MHz
The price: $225.00

(Accessory rechargeable battery available: $22.00)

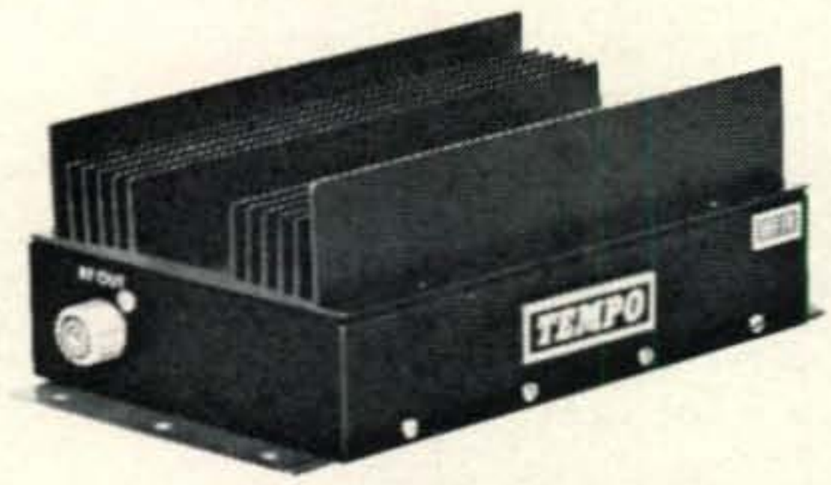


TEMPO/220 TR

A brand new 220 MHz solid state AM/FM transceiver. The 220 TR's power output is 4 Watts on FM, 1.5 Watts on AM. The receiver is double conversion with a tunable receiver. FM is detected by a limiter discriminator featuring full noise saturation for weak signal reception. AM signals are detected by a bridge diode detector and full AGC is employed to make the most high powered signals distortion free. Sensitivity is typically .3 microvolts for 20 db quieting. Tuning is accomplished in two bands, 220-222.5 MHz and 222.5-225 MHz. Its size . . only 7"W x 2⅜" H x 10½" D. Its price . . only $220.00

TEMPO/fmv 2

So much for so little! This little 10 Watt VHF FM transceiver offers high quality performance and features usually found only on more expensive units. Features such as AFC on receive and separate switchable Transmit/Receive sections. Includes mounting bracket, heavy duty power cord and provisions for accessory AC power supply. Frequency: 146-148 MHz, 11 channels, 25 KHz channel spacing, 13.8 VDC ±10% operation (standby −100 ma, receive −150 ma, transmit −3.0 amp.)
The price: $199.00



TEMPO/TPL high power fm amplifiers

Miniature power houses! Operates directly from a 12 VDC power source, automatic antenna switching, incorporates Balanced Emitter transistors and state of the art design practices, making it virtually immune to damage due to high VSWR or misloading conditions.

MODEL NUMBER	POWER INPUT	POWER OUTPUT (min)	BAND	PRICE
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TPL802	5W	80W	2M	$180.00
TPL802B	1 to 3W	80W	2M	$195.00
TPL502	5 to 15W	35-55W	2M	$105.00
TPL502B	1 to 3W	45W	2M	$130.00
TPL252-A2	1W	25W	2M	$ 85.00
TPL445-10	1 to 2.5W	12W	440MHz	$125 00
TPL445-30	4W	30W	440MHz	$215.00
TPL445-30B	1W	30W	440MHz	$235.00

TCP 12A Control Head . . . $32.00

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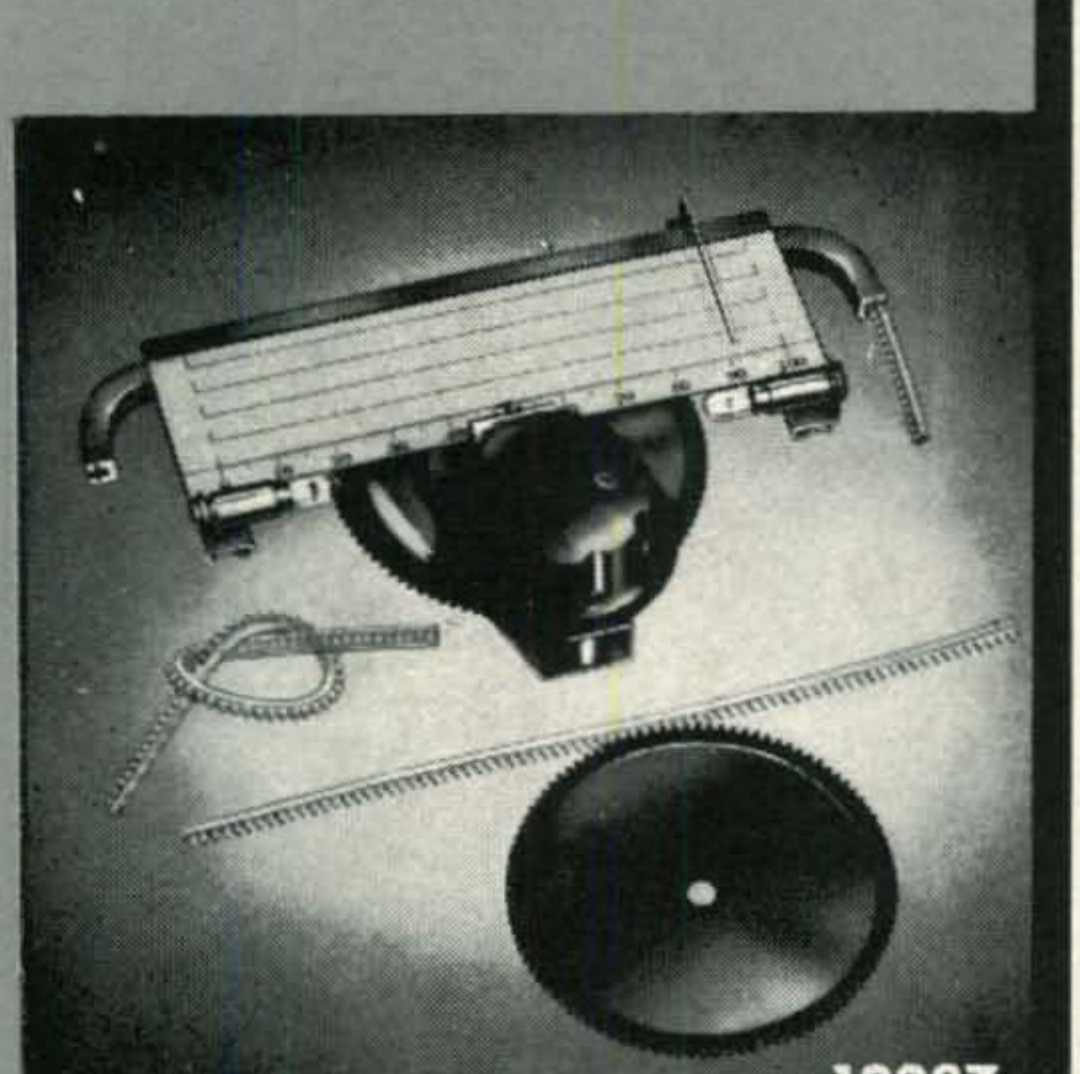
Application



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No strings: no pulleys: no back lash: no flimsy assembly. The No. 10037 is a sturdy mechanically engineered "Designed for Application" dial assembly which completely eliminates the annoyances of string-driven pointers, eliminates all indicator stutter or wobble and provides positive pointer travel and resetability. The pointer is driven positively by a flexible but non-elastic molded gear driven rack which cannot slip, break or fall off a pulley. The geared flexible rack rides in a multi-slot extruded aluminum channel. This girder-like extruded piece provides mechanical rigidity to the assembly. Furnished complete with panel trim bezel and flexible coupling for output shaft.

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Q AND A

BY CHARLES J. SCHAUERS, W6QLV

We old-timers (OT's) learned the hard way through a lot of study, set construction, antenna erection and what have you! Shortcuts were few and we had to do with what was at hand.

Except for the code, the newcomer of today can, with planned study and not too intensive concentration, obtain his license in 7 weeks or less.

But with all the years behind us, we OT's still continue to learn — we don't know it all and never will. We keep cracking books to find out more about SSTV, IC's and the techniques which will make amateur radio more satisfying. However, even with the most modern techniques amateurs continue to have problems — and they are not all technical.

There is still a lot of old equipment in use, today but new equipment is being bought every day.

Q&A caters to all amateurs but has a soft spot in its "heart" for the young amateur or amateur-to-be.

So when you write us put your question on a postcard — be brief and to the point. We'll try to help you.

IC f.m. i.f. System

"I do a lot of experimenting and need an IC module which will give me an i.f. amplifier, quadrature detector, a.f. preamplifier and circuits for a.g.c., a.f.c., squelch and tuning meter. Any suggestions?"

Sure, try the RCA CA3089E. This will give you something to start with.

Difficult Service?

"I sold all of my equipment in 1945 and have

Q & A is a free technical assistance program offered by CQ its readers. We ask your cooperation to enable us to assist many amateurs each month as possible. Always include a self-addressed stamped envelope with your question. Only one question per letter, please. Before writing to ask where a published article appeared, try to find it yourself by consulting the annual indexes of the various amateur magazines. Mail questions to CQ Q & A, 14 Vanderventer Ave., Port Washington, N.Y. 11050

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- ! Height, including mount . . . 78″
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- ! Field adjustable for lowest SWR

CHOOSE FROM TWO VERSIONS

MODEL CGT-144 (illustrated) antenna complete with trunk lip mount for easy, no holes installation on side or edge of trunk lip. 180° swivel included for adjustment of antenna to absolute vertical. Supplied operational with 17′ MIL spec RG-58-U and PL-259 transceiver connector factory attached. Antenna is removable from mount. Shpg. Wt. 3.34 lbs. **$36.95**

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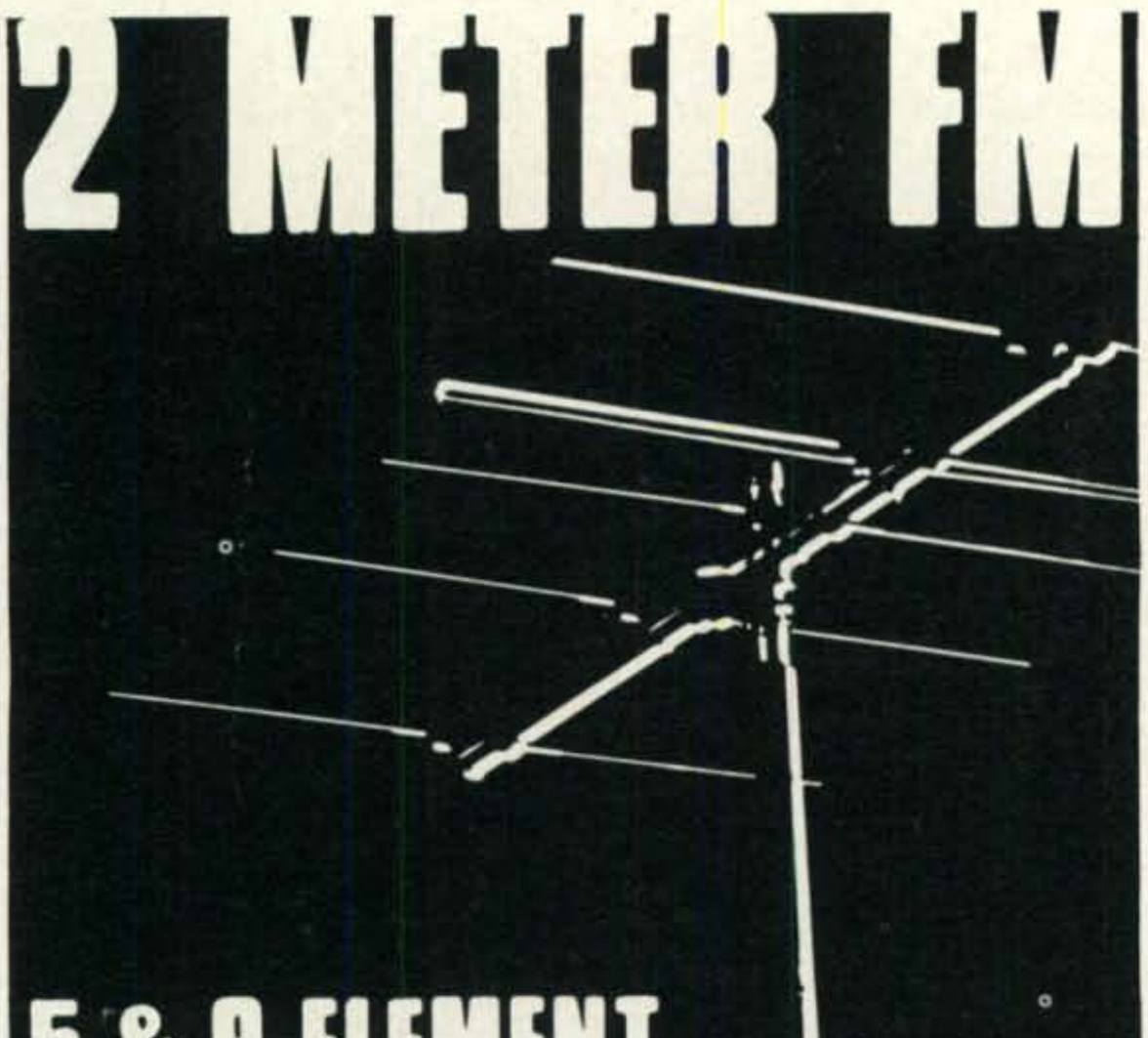

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GAIN: 12 db.
Model: MY-144-5

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GAIN: 16 db.
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Matching system incorporates a 200 Ohm folded dipole with a 4 to 1 coaxial balun. Element length is adjustable for critical tuning.

VERTICAL GROUND PLANE...

with special custom features for 150 to 170 MHz.

Gain: 3.4 db. compared to 1/4 wave ground plane. Power Rated: 1 KW AM; 2 KW P.E.P. SSB. Frequency Range: 144 - 148 MHz. with special custom features for 150 - 170 MHz.. VSWR: 1.5/1 or better at resonance.

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Model: DI-2

DIPLOMAT SPECIAL
Model: DI-2A

For detailed specifications, see your authorized Mosley Dealer or write Dept. 212 . . .

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4610 N. Lindbergh Blvd., Bridgeton, Mo. 63044

not operated since. Now the bug has 'bitten' me again and I'm in the market for a good transceiver, linear etc.

"I was surprised how easily I passed the Extra class exam.

"Here's my problem: I can shoot trouble on any tubed set but when it comes to transistors and modules, boy, I'm way out in left-field. Oh, I know how transistors work etc., but my troubleshooting knowledge concerning these is about nil.

"Should I pick up a good used KWM-2 or consider the newer models containing oodles of transistors and diodes?"

Troubleshooting is and always has been a process of elimination. The newer sets with plug-in modules are not difficult to service *if* you have only two instruments — a vacuum tube voltmeter (v.t.v.m.) and a scope.

When IC's are used the troubleshooting problem can be a bit complicated (what with 16 leads) in some cases! But most manufacturers (if they are 'on the ball') will furnish you with a good instruction book that makes troubleshooting easy.

The point to remember is that *most* transistor and IC failures are due to voltage transients or a defective power supply. Before you pull one module always check voltages — a regulator may be involved too — zeners etc. are not immune to failure, and neither are filter, bypass or any other capacitors. Resistors (especially in IC's) can 'go'.

Collins and I have been friends for years and I have used their equipment, but tubes do fail more often than transistors — believe me.

TR4-A Audio

"I recently acquired a TR4-A from a friend of mine. He only used it about 20 hours. It is an early model with a noise-blanker. He complained about low audio output — now I'm doing the same. What do I do?"

Write Drake and ask about their audio module (easy to install). I have a Drake (among others) that had the same problem. Henry Radio installed a module and there's no problem now. It's a good set.

Logging

"I'm a traveling salesman and recently installed an all-band rig (except for 2 meters) in my car. I generally operate in motion. How do I log?

You need only to log starting and stopping times of operations (a given period) and a list of stations worked during the period. This only applies to mobiles-in-motion and *not* to a fixed location.

400% MORE AVERAGE SSB POWER OUTPUT

USE A **MAGNUM SIX** QUALITY R F SPEECH PROCESSOR

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Drake 149.95
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Swan and other models available soon. Add 5% Tax in Washington

- Your voice works your transmitter at less than 20% of its key down CW capability. By adding the **MAGNUM SIX** to your existing rig you can increase your average SSB voice power output by 400% (6db).

- Recent editions of the ARRL handbook describe RF speech clipping as clearly the most effective and efficient method to increase SSB talk power. The **MAGNUM SIX** achieves quality RF clipping in the IF strip of your transmitter for highest effectiveness and least distortion.

- Voice quality and splatter free narrow-band signal output are assured by use of the high quality American made bandpass filter in the **MAGNUM SIX** for sideband selection prior to clipping and use of your existing transmitter bandpass filter for elemination of distortion products after clipping.

- PUT YOUR TRANSMITTER TO WORK FOR THE FIRST TIME IN ITS LIFE. POWER UP WITH A **MAGNUM SIX** FOR THE MOST ADDED POWER PER $ THAN ANY OTHER METHOD.

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- **12 Channels**
  You don't need 12 channels yet? You will! You will!
- **Tweak BOTH xmtr & rcvr**
  Big deal? You'll know it is if you get a set where you can't zero the receiver.
- **Front speaker**
  Most sets have the speaker aimed up under the dash or at your feet with the result that you can't hear diddely beans. The front speaker can be heard, even when you are driving.
- **10 watts.** Also 0.1 and 1 watts, switchable.
  Big deal? Have you thought how easy it is to make this little set into a shoulder unit with a small battery pack? The low power position is excellent for this.
- **Very, very small.** Tiny, in fact. Mounts anywhere.
- **Minimum adjacent channel interference.**
  The ceramic filter eliminates most adjacent channel spillover. You may not appreciate this unless you've tried a couple of other sets and found them unusable anywhere near a strong signal.
- **S-meter.**
  Big deal? How many sets in this price bracket have an S-meter and power output indicator meter? The S-meter is very handy.
- **Includes matching mike,** mounting bracket, etc.
- **Available with tone burst** encoder built in and tested.
  Ross & White also makes these tone burst units and sells them. Send for prices and info.
- **Can you do without** this terrific FM unit one more week? Don't miss any more of the fun on 2m. Instant delivery, prepaid!

ORDER RIGHT NOW!

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SB-36 Info

"I have owned the SB-33 and SB-34 transceivers. What do you think of the SB-36?"

So have I. As yet I have no tech info on the SB-36 and hope the manufacturer will come through. I had a lot of fun with the 33 and 34. Until I personally check out the SB-36 (through personal purchase) I cannot venture an opinion.

Quick Diode Check

"I'm a Novice with a lot of diodes on hand. How can I quickly check these — I have two high school projects in which I intend to use them?"

If a diode is shorted, the short will show up with a full ohmmeter reading when the prods of the meter are applied to either end (regardless of polarity). If open, no meter reading or application of the prods to either end. If good there will be a high back resistance in one direction and very little or no resistance in the other when prods are switched.

Hi-Fi "I"

I guess I have tried just about everything trying to get rid of 15 meter hi-fi 'I'.

"I've tried traps, by-passes, coaxial cable etc without results.

"The only time I have the problem is when play records. On radio or tape — no problem. What can I do to stop this annoying problem (more for my wife than me)?"

I had the same problem but I fixed it. Take two small lmh r.f. chokes. Connect each in series with the pickup leads *at* the amplifier. This will take care of about 95% of your problem. (the other 5%) is to run a ground (with small wire in this case) to the amplifier chassis and the *metal* mounting plate of the turn-table.

CB "I"

"About a block down the street is a CB'er. His little 'ole rig (base station) knocks the heck out of my 10 meter operations. I offered to help him clear up the trouble but he could care less. He is not cooperative at all. Anything I can do?"

As long as you are not bothering anyone, I would suggest you contact the FCC.

Many CB sets are over-modulated, poorly grounded, mis-tuned and any QRM is usually the owner's and *not* the manufacturers' fault. I suggest you invite your CB "friend" over for a coke or beer — show him how your set operates and then have him operate his set and "see" the difference. Try to make a friend — not an enemy. CB has its place and so does amateur radio!

With Signal/One's CX7-A you settled for the best.

Now meet the rest of the best.

A few short years ago, Signal/One introduced the solid-state CX7-A. It was quickly recognized as the world's most advanced radio transceiver. It still is.

Now, Signal/One is more than just the CX7-A. A lot more.

For openers, we've added two new receivers. One, the CR-1500, a dual-channel system is so advanced — in selectivity, sensitivity and versatility — you won't find anything like it this side of a research laboratory. The CR-1200 receiver, our other new one, features a single VFO. If it weren't for its bigger brother, it would be the finest receiver you could buy.

There's a new CT-1500 transmitter, the matching transmitter for use with the CR-1200 and CR-1500 receivers. It incorporates all modes of operation and includes the famous Signal/One RF envelope clipping, broadband tuning, full-automatic CW keying, and many other features.

We're also introducing a new transceiver, the CX-10, which contains several CX7-A features. In addition, it can be used with either our new AC or DC power supplies, an external VFO, and other accessories.

Our new accessories include a deluxe station console, speakers, 2-meter and 6-meter transverters with direct digital readout and FM capability, and custom microphones.

In the past years, there were one or two names in amateur radio gear that meant the finest. In their time they were.

Times have changed. Now, if you want the finest, choosing is easy.
It's all at Signal/One.

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Start earning $5 to $7 an hour in your spare time servicing television and radio sets . . . with NRI's TV-Radio Servicing Course. NRI supplies you with simple "bite-size" texts, a step-by-step learning program; and an exclusive 25" square picture tube, solid state, color TV set that you build yourself as you learn.

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Transistor Substitution

"I bought a group of so-called obsolete transistors. I checked them out and they're all good — believe it or not.

"As you know many circuits list the newer transistors. How can I determine which ones to use where?"

There are many transistor substitution manuals available. I suggest you obtain one.

U.H.F. High Power Transistor

"I need an r.f. power transistor which will handle 15 watts, but it must be cheap. I need it for a 2 meter rig I'm building. Where can I get one?"

You can get what you need for $3.95 from *Poly Paks,* Lynnfield, Mass. Ask for their 2N3632 or equivalent. The transistor they are offering at this price will go to 400 mHz, is rated at 23 watts-3 amps. You can also use a 40665 or a GE-66.

Printed Balloon Antenna

"I have some metro balloons. Any reason why I can't paint a couple of dipole antennas on these and use them on 2 meters. What I expect to do is gas them up — use a small 72 ohm line and let 'em float above trees etc.

"I imagine I could change frequency by less or more inflation. What do you think?"

This is no crackpot idea I can tell you! While in the service (during 1958) I suggested this be done for jungle warfare communication and even radar antennas but no one listened to me. The inflatable antenna is not new but end-connections pose a problem and the paint used for antenna "elements" can be expensive. Anyone have any ideas?

V.H.F. Rhombic Dimensions

"I have space for a 6 meter rhombic and would like to try one. Do you think it is worthwhile?"

For 6 meters, a rhombic of 59° (tilt) would require about 97 feet in the "long direction" and 65 feet (ns). Personally, I'd rather use a beam that can be rotated.

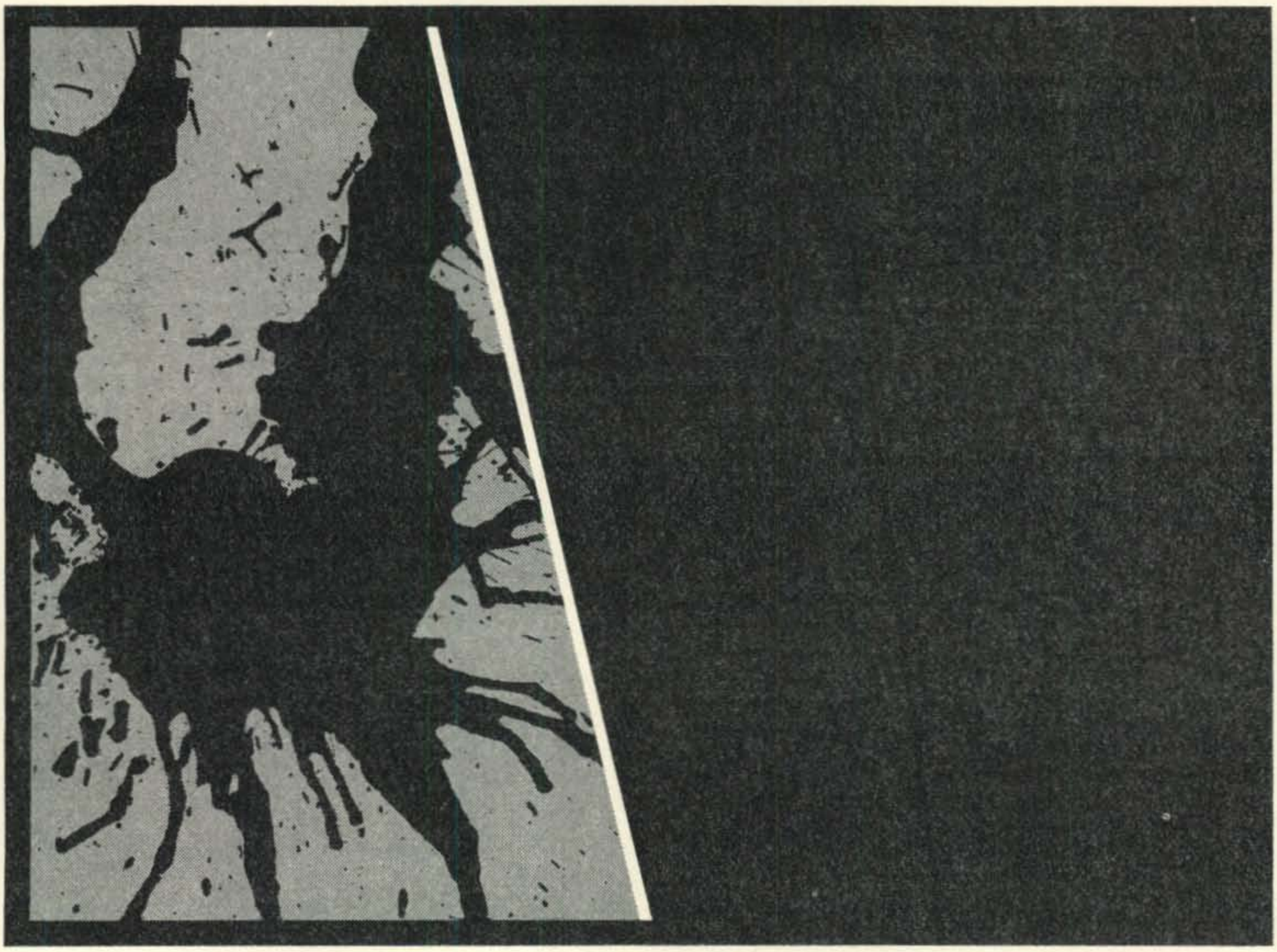
Mercury Switch "I"

"After installing five mercury 'silent' switches in the house we not only have TVI, static on our a.m. receivers but also on my Tempo-One. No matter what I did I could not eliminate the noise from one switch.

"The lights which are controlled by the offending switch do not blink. What do I do?"

Replace the switch.

[*Continued on page 88*]



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OSCAR-6: IT'S IN ORBIT!!!

By George Jacobs,* W3ASK

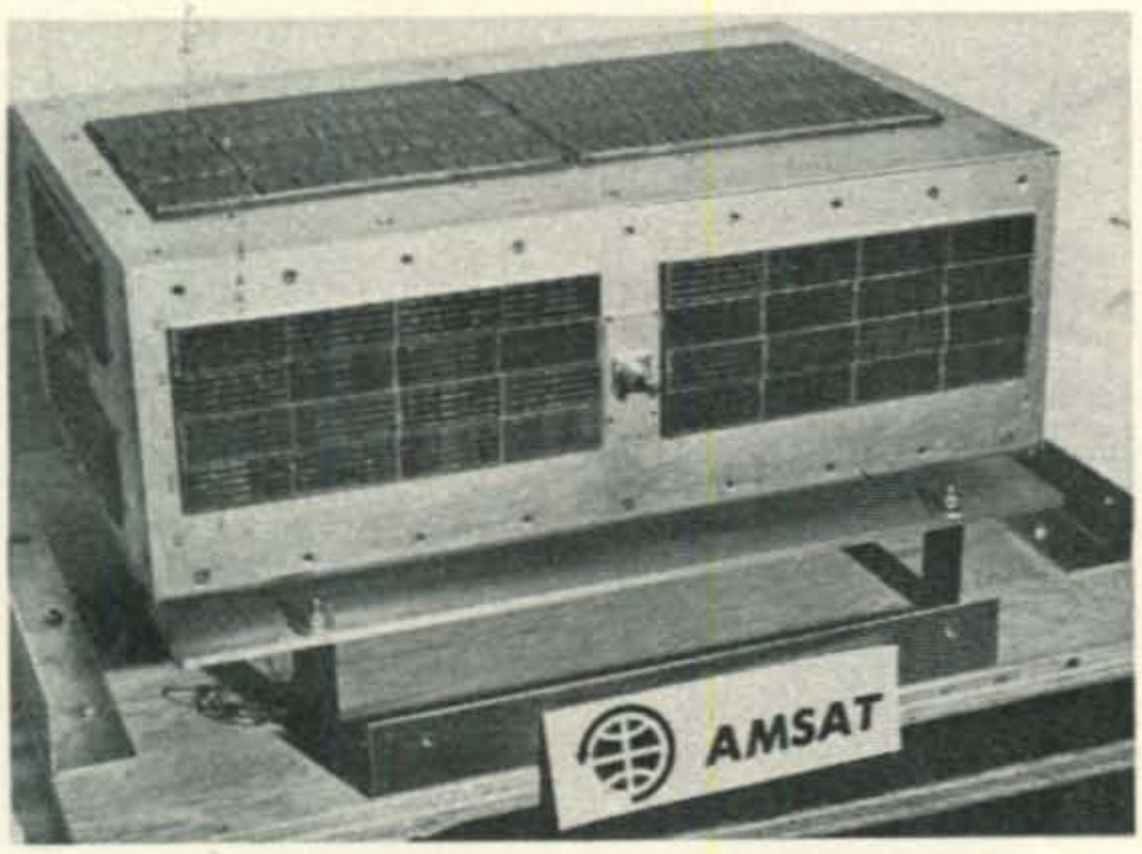
OSCAR-6 is in orbit, and its 2-to-10 meter repeater is in operation. One week after launch, as this is being writtn, well over 100 stations have worked through the repeater on c.w., ssb, sstv and rtty, and it looks like OSCAR-6 will break all previous amateur radio satellite records.

OSCAR-6 began its piggyback ride into space amid a tremendous roar and a blinding blaze of flame and smoke at precisely 18 seconds past 1719 GMT on October 15.

The 40-pound satellite, built by radio amateurs on three continents, was nestled firmly in the framework of a giant Thor-Delta booster rocket as it began to lift slowly off its pad at NASA's Western Test Range near Lompoc, California. In the rocket's nose was the primary mission ITOS-D weather satellite.

An hour and five minutes later, over southern Africa, as the Thor-Delta booster attained its orbital altitude of approximately 900 miles, the OSCAR-6 satellite was ejected separately from ITOS-D, and its repeater turned on.

*Space Communications Editor, *CQ*, 11307 Clara St., Silver Spring, Md. 30902



The Oscar-6 amateur radio communications satellite completely assembled and waiting to be installed in the Thor-Delta booster rocket. The 17 x 12 x 6 inch satellite weighs 40 pounds. Its sides are covered with solar cells.

A few minutes later, as OSCAR-6 passed within range of Ethiopia, ET3JH became the first radio amateur to work through the repeater when he received his own c.w. and a.m. transmissions.

As it passed within range of Europe on its initial orbit, so many stations worked through the repeater that according to one observer: "it sounded like 40 meters on a Sunday afternoon"!

K1HTV, for example, reported hearing several European stations (including DJ7CWA and DL9AR) as well as USA and Canadian stations as far west as California (K6QEH) ,during OSCAR-6's first orbit.

One of the first 2-way QSOs reported took place on c.w. between G3LQR and DJ7RI.

After the first full week of operation, well over 100 2-way QSOs have been reported, including a large number of trans-Atlantic contacts. More details, including callsigns, in next month's issue of *CQ*.

Repeater Overloading

The OSCAR-6 2-to-10 meter repeater has been so popular, that its use by so many stations at the same time has created a technical problem. For example, during one pass this Editor heard at least 32 stations on c.w., 6 on s.s.b., 1 on SSTV and 1 on RTTY.

The repeater's power output of just over one watt is divided between *all* of the stations that are working through it at any given moment of time. So many stations are using the satellite, *many with powers in excess of 100 watts e.r.p.*, that the satellite's power supply has been overtaxed. This has resulted in reducing the level of all signals in the 10 meter downlink passband, especially that of the beacon signal on 29.45 mHz. Under extreme loading, the power drain has been high enough to cause the repeater to suddenly cut-out, and remain off until turned on again by ground control.

In order to avoid premature loss of the repeater, it is urged that *all users limit their effective radiated power (e.r.p.) to less than 100 watts*. (Effective radiated power = transmitter output × power gain of antenna in direction of satellite.) That this is an adequate level of power can be seen from the

successful results of K3GKB, who has worked through the repeater with less than 10 watts e.r.p.

Confirmed Orbital Parameters

It was a textbook launch, and all indications are that the OSCAR-6 satellite is performing almost exactly as planned. Here are the vital statistics of its orbit as established after its first week in space:

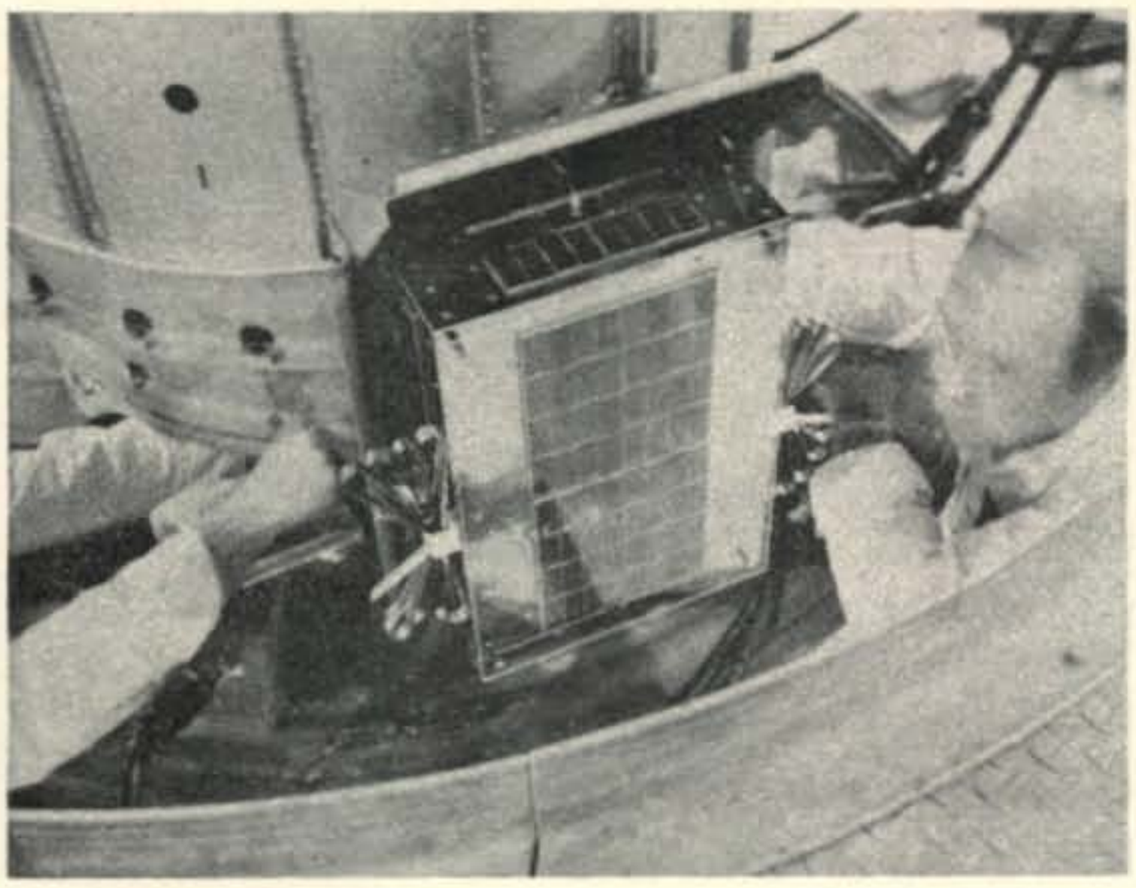
Date of Launch: October 15, 1972.
Time of Launch: 17:19:18 GMT.
Place of Launch: NASA Western Test Range, Lompoc, California.
Period: 114.95 minutes
Inclination to Equator: 101.73 degrees
Equatorial Crossings: 28.75 degrees progressively to the west for each new orbit in a south-to-north direction.
Velocity: 250 miles per minute
Uplink frequency passband: 145.90 to 146.00 mHz.
Downlink frequency passband: 29.45 to 29.55 mHz.
Downlink-Uplink Frequency Relationship: $F_{down} = F_{up} - 116.45$ mHz $\pm F_{doppler}$ where $F_{doppler} = +$ 4.5 kHz near the beginning of an overhead pass;
$= 0$ kHz at the middle of the pass;
$= -$ 4.5 kHz near the end of an overhead pass.
Beacon & Telemetry Frequencies: 29.45 and 435.1 mHz.
Beacon & Telemetry Modulation: A-1 emission (c.w.)
Operating Modes: C.w. and s.s.b. are recommended. Two-way QSOs have been reported using SSTV and RTTY. *Do not use f.m.*

For a more complete listing of the satellite's technical parameters, see "OSCAR-6; It May Already Be In Orbit," in the November, 1972 issue of *CQ*.

Late Orbital Info

Up to the minute orbit data, in terms of time and geographical coordinates of south-to-north equatorial crossings, are given daily on the official ARRL bulletins transmitted by W1AW in c.w. at 0000 and 0400 GMT on 1.805, 3.580, 7.080, 14.080, 21.080, 28.080, 50.080 and 145.588 mHz at 18 w.p.m. Phone bulletins ae transmitted at 0100 and 0330 GMT on 1.820, 3.990, 7.290, 14.290, 21.390, 28.590, 50.190 and 145.588 mHz.

Similar information can be obtained 24 hours a day from the AMSAT-OSCAR-6 hot line telephone number: Area Code 301-654-1166.



Oscar-6 being installed in the Thor-Delta booster. It rode into space piggyback with an ITOS-D weather satellite on October 15, 1972. The repeater's 10 meter dipole antenna, made of standard carpenters rule, can be seen folded into the sides of the satellite.

The satellite's orbit crosses the equator at an angle of 102 degrees when traveling in a south-to-north direction. During the hours of darkness the satellite travels south-to-north, while during the daylight hours it travels fromnorth-to-south. Geographically, the satellite sees a circular area approximately 4600 miles in diameter, with the point on earth directly beneath the satellite as its center. Communications should be possible for up to twenty minutes during nearly overhead passes, and progressively less on passes to the east and west. Three or four consecutive orbits pass over the USA each morning and evening, for a total of between six and eight passes every day.

For more complete details concerning or-

Plaque inserted in Oscar-6, and now in orbit, in memory of W3ZM, an outstanding radio amateur and a pioneer in AMSAT who joined Silent Keys earlier this year.

Channel	Measured Parameter	Unit	Measurement Range	Calibration Equation
1a	Calibration	—	80	N* = 80 counts
1b	+ X Solar Panel Current	I (ma)	0 to 100 ma	I —1.078N + 105.8
1c	—X Solar Panel Current	I (ma)	0 to 100 ma	I —1.102N + 107.2
1d	+ Y Solar Panel Current	I (ma)	0 to 200 ma	I —2.240N + 219.0
2a	—Y Solar Panel Current	I (ma)	0 to 194 ma	I —2.105N + 205.5
2b	+ Z Solar Panel Current	I (ma)	0 to 370 ma	I —4.300N + 417.0
2c	—Z Solar Panel Current	I (ma)	0 to 370 ma	I —4.100N + 402.5
2d	Battery Charge or Discharge Current	I (ma)	—500 to + 500 ma	I 10.00N— 500
3a	Unregulated Bus Voltage	V	12.4 to 30 v.	V 0.174 N + 12.4
3b	1 2 Battery Voltage	V	0 to 15 v.	V 0.161 N
3c	Switching Reg. Voltage	V	0 to 15 v.	V 0.147 N
3d	Battery Temp.	°C	—30 to + 50°C	T —1.471 N + 95.79
4a	Baseplate Temp.	°C	—30 to + 50°C	T —1.471N + 95.79
4b	Repeater P.A. Temp.	°C	—30 to + 50°C	T —1.471N + 95.79
4c	+ X Panel Temp.	°C	—30 to + 50°C	T —1.471N + 95.79
4d	+ Y Panel Temp.	°C	—30 to + 50°C	T —1.471N + 95.79
5a	+ Z Panel Temp.	°C	—30 50 + 50°C	T —1.471N + 95.79
5b	Repeater P.A. Emitter Current	I (ma)	0 to 500 ma	I 5.00 N
5c	Repeater Switching Reg. Voltage	V	0 to 30 v.	V 0.30 N
5d	Instrumentation Switching Regulation Current	I (ma)	3.8 to 63.8 ma	I 0.601 N + 3.80
6a	Repeater R.F. Power Output	mw	0 to 10,000mw	P 1.0 (N)²
6b	435.1 mHz Beacon R.F. Power Output	mw	0 to 1,000 mw	P 0.10 (N)²
6c	Repeater a.g.c. Voltage	V	0 to 3 v.	V 0.03 N
6d	Mid Range Calibration	V	0 to 1 v.	N 50 counts ± 1

Table I—OSCAR-6 Telemetry Data Decoder

bital calculations see, "Getting Ready For The OSCAR-6 Satellite," appearing in *CQ*, June, 1972, p. 31.

Control & Telemetry

All ground control functions of the OSCAR-6 satellite appear to be functioning normally. On several occasions when the repeater cut out, apparently due to signal overload, it was successfully turned on by ground control from selected stations in the U.S.A. and Australia.

Apparently as a result of signal overloading, the 10 meter beacon and telemetry transmissions on 29.45 mHz often have been very weak and difficult to copy. Fortunately, just before launch it was possible to place a 435.10 mHz beacon aboard the satellite, which operates independently of the repeater.

Novel Telemetry System

The telemetry system aboard OSCAR-6 represents a new, and simplified approach in conveying telemetry data. It relies on the straightforward transmission of numbers in Morse Code at 20 w.p.m. The system measures 24 different satellite parameters and spews out a complete set of readings in 90 seconds. The sequence is repeated at least nine times during each transmission.

Telemetry transmissions on 29.45 and 435.10 mHz begin with the familiar HI (. . . . ..), followed by 24 groups of three numbers each, as shown in the following example:

		a	*b*	*c*	*d*	
1	HI	180	132	102	141	
2		202	235	200	263	
3		352	380	368	355	
4		457	452	453	458	
5		558	524	530	500	
6		633	600	687	650	HI

(The letters and numbers shown in italics are not part of the telemetry transmission, but are used to identify telemetry channels; *1a, 2c, 3b,* etc.).

The first number in each three-number group is associated with a parameter shown in Table I. The last two numbers in each group indicate the relative level of measurement. When this value is inserted in the calibration equations given in Table I, the actual level being measured can be determined. For example, the telemetry value corresponding to channel *3a* is given in the above sample transmission as 352. Table I shows that channel *3a* is the "Unregulated Bus Voltage." When the value 52 is inserted in the calibration equation (V_{bus}= 0.174 N + 12.4 12.4 volts), a reading of 21.488 volts is obtained. The telemetry value associated with channel *6a* is shown as 633. Table I shows that this is the "Repeater R.F. Power." Inserting the value 33 into the appropriate calibration equation results in a reading of 1089 mw, or 1.089 watts. The telemetry sequence ends with HI.

Reporting OSCAR-6

AMSAT has developed a reporting format, called the "OSCAR-6 Communication Report," to aid amateurs in reporting their results. The suggested form consists of three parts. (See Table II) Part I contains questions about your station; pertinent details of two-way QSOs made through the satellite go in Part II; while Part III is for reporting stations you may have heard through OSCAR-6, but did not work.

Part I, Station Information, need be completed only the first time you send in a report, and any time thereafter that the basic

*N is the last two numbers appearing in each three number group contained in the telemetry transmission.

Table II—OSCAR-6 Communication Report

Name ..... Call .....

Date Of Report ..... Period Covered .....

Send Reports To: AMSAT, Telemetry Dept., P.O. Box 27, Washington, D.C. 20044
PART I. Station information (Fill in only if this is your first report, or if information has changed since your last report.):

Address .....

Country ..... AMSAT Member? ..... Source of Orbital Data .....

Latitude .....° ..... min (N) (S) Longitude ....° .... min (E) (W)

145 mHz Power Output .....W. Antenna Type & Polarization .....

29 mHz Receiver ..... Antenna Type & Polarization .....

435 mHz Receiver ..... Antenna Type & Polarization .....

Did You Hear: 29.45 mHz Beacon? .... (RST) 435.10 mHz Beacon? .... (RST)

PART II. Summary of Completed Two-Way Contacts:

Date	Time GMT	Station Worked	His Signal RST	My Signal RST	His Mode	My Mode	Time Of Ending QSO (GMT)	Comments

PART III. Summary of Amateur Stations Heard Through OSCAR 6.

Date	Time Of AOS (GMT)	Station Heard	His Signal RST	His Mode	Heard Calling Or Working (Call Sign)	Time Of LOS (GMT)	Comments

information changes, *e.g.*, you add more power, or change antennas, or move your location. If nothing has changed, it need not be filled out on the second and subsequent reports. Give your complete address in Part I, including ZIP code and country, whether or not you are an AMSAT member (you need not be a member to submit reports or to receive acknowledgement), and the source of the orbital data with which you tracked the satellite (*e.g.* W1AW, AMSAT Hot Line, self-generated, etc.). Give your latitude and longitude in degrees and minutes, as accurately as possible. 145 mHz power output should be given as d.c. power *into* the antenna, taking into account amplifier efficiency and transmission line losses. Assume that 2 watts s.s.b. = 1 watt d.c. for this calculation. Receiving information should contain the type receiver if it is commercially made, or give the front end tube or transistor type if it is home-brew or a converter. Antenna types should be given as well as polarization (horizontal, vertical or circular).

Part II is a summary of two-way contacts made through the satellite. To qualify, a QSO must be complete enough to count as a complete QSO in a contest, or for WAS; each station must receive both a complete signal report (RST) plus positive acknowledgement (R) that the other station copied his report and call sign correctly. Both stations, of course, must be transmitting in the two meter passband and be repeated through the satellite's 10 meter passband. Modes can be given as either A1, A3A, F1, etc., or as c.w., s.s.b., SSTV, etc.

Part III is for stations heard but not worked. Time of AOS (Aquisition of Signal) and LOS (Loss of Signal) refer to the times at which you first heard and finally lost a particular signal during the orbit. If you copy many signals during an orbit, list each one separately. If the station you hear is working another station, or calling CQ or test, indicate this information in the "Heard Calling or Working" column. If you hear both sides of a QSO, report both stations as separate items, with overlapping times. Any unusual propagation should be noted in the comments columns of both Parts II and III; especially observations of flutter, scintillation, auroral effects, etc.

OSCAR-6 is an undertaking of AMSAT, the Radio Amateur Satllite Corporation. The group is affiliated with ARRL and receives modest League financial support. AMSAT membership is open to anyone interested in satellite communications. For a membership application, drop a note and an s.a.s.e. to AMSAT, P.O.Box 27, Washington, D.C. 20044. ■

Satellite Turnstiles

By Dale W. Covington,* K4GSX

It has been suggested recently that the omnidirectional properties of a stationary turnstile antenna might be usefully employed in receiving signals from the Amsat OSCAR-6 satellite.[1] [2] Details on adapting the turnstile for satellite reception are discussed below.

Theoretical Details

The basic turnstile consists of two horizontal dipoles crossed at right angles. The dipoles are fed with equal currents having a 90° phase difference.

Brown[3] has shown that the field in the plane of two crossed infinitesimal dipoles fed in phase quadrature exhibits a circular pattern. However a relatively uniform response in all directions is desirable as the satellite passes over a stationary antenna. Figure 1 shows the turnstile antenna at a height H above ground. Spatial directions of the satellite position with respect to the antenna are identified with the aid of angular coordinates drawn on an imaginary hemisphere surrounding the antenna. A spatial directional pattern[4] plots the antenna response over this hemisphere. Contour lines of constant db down are drawn on a planar projection of the hemispherical grid. The projection employed in the present study is a simple polar diagram.

Using computer techniques,[5] the directional patterns were derived for turnstile antennas at heights of ¼, ⅜ and ½ wavelength above perfect ground. Figure 2 compares the pattern for a horizontal turnstile with the pattern for a single dipole having a common height of ⅜ wavelength. The turnstile clearly provides the more uniform response by showing less than a 3.0 db variation over the entire polar cap extending down to elevation angles of 25°. In contrast, some areas of a similar cap in the single dipole pattern contain variations of 11 db. Antennas at other heights appeared to be less omnidirectional. The polar region containing less than a 3.0 db variation extended down to 44° for a turnstile height of ¼ wavelength. At ½ wavelength a sharp null of 12 db or more developed for elevation angles greater than 66°. Multiple lobe characteristics are introduced into the patterns for heights above ½ wavelength. Heights at ½ wavelength multiplesare useful however to obtain improved response at low elevation angles in DX communication.

For the case of real ground, the reflected wave contribution to the total radiation pattern becomes a function of not only the angle

*281 Vance Circle N.E., Marietta, Ga. 30060

[1] Jacobs, G., "Summer Launch Planned for OSCAR 6," *CQ*, May 1972, p. 40.
[2] Didelot, G., *Radio REF*, p. 467 (June 1972).
[3] Brown, G. H., *Electronics, 9*, p. 14 (April 1936).
[4] Christiansen, W. N., *A.W.A. Technical Review, 7*, p. 33 (1946).
[5] Covington, D. W., "Radiated Power Patterns for Multiband Dipoles," *QST*, Nov. 1971, p. 42.

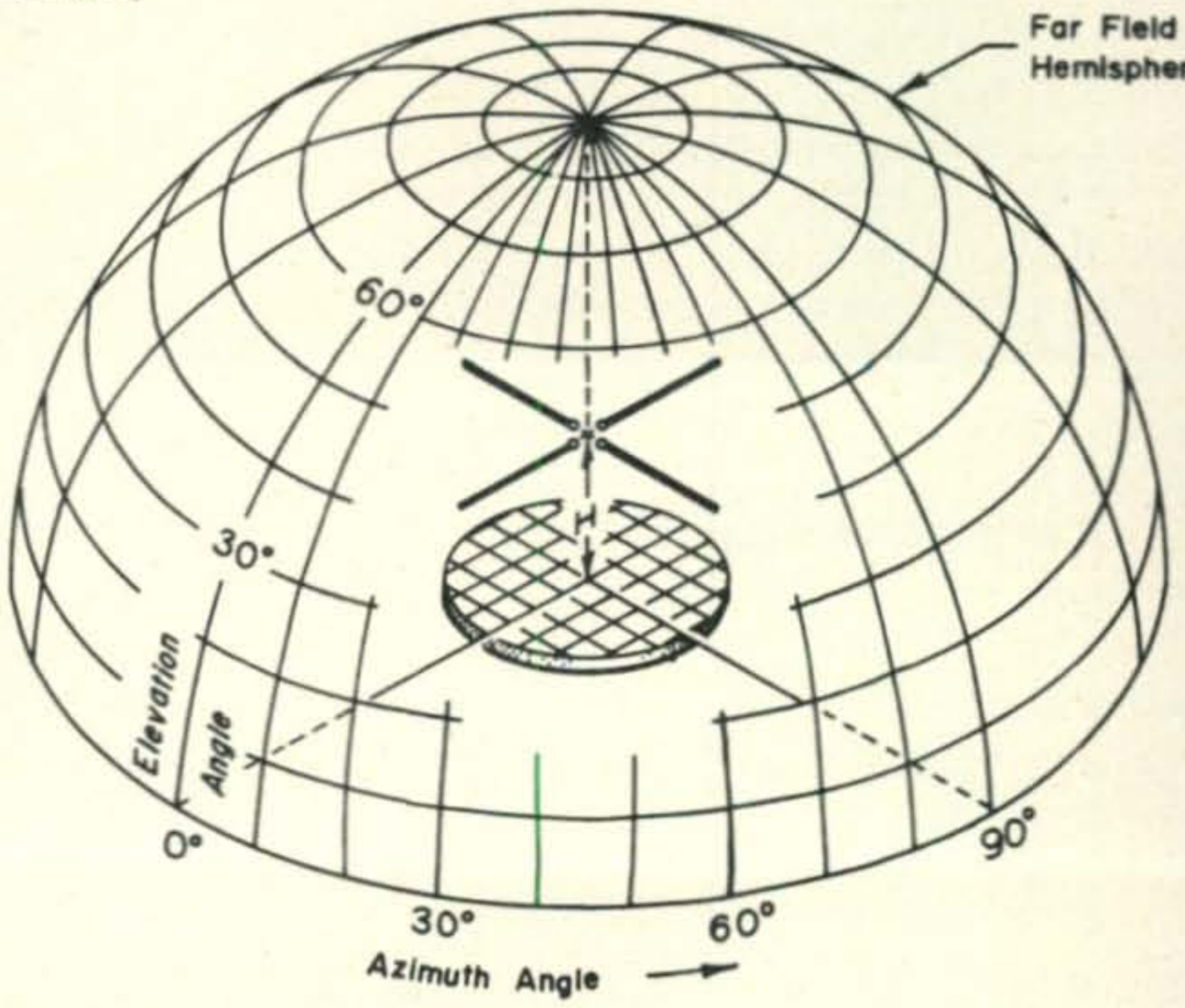


Fig. 1 — Isometric view of a turnstile antenna mounted at a height H above ground. Directions in space above the antenna are read from the grid coordinates marked on the far field hemisphere.

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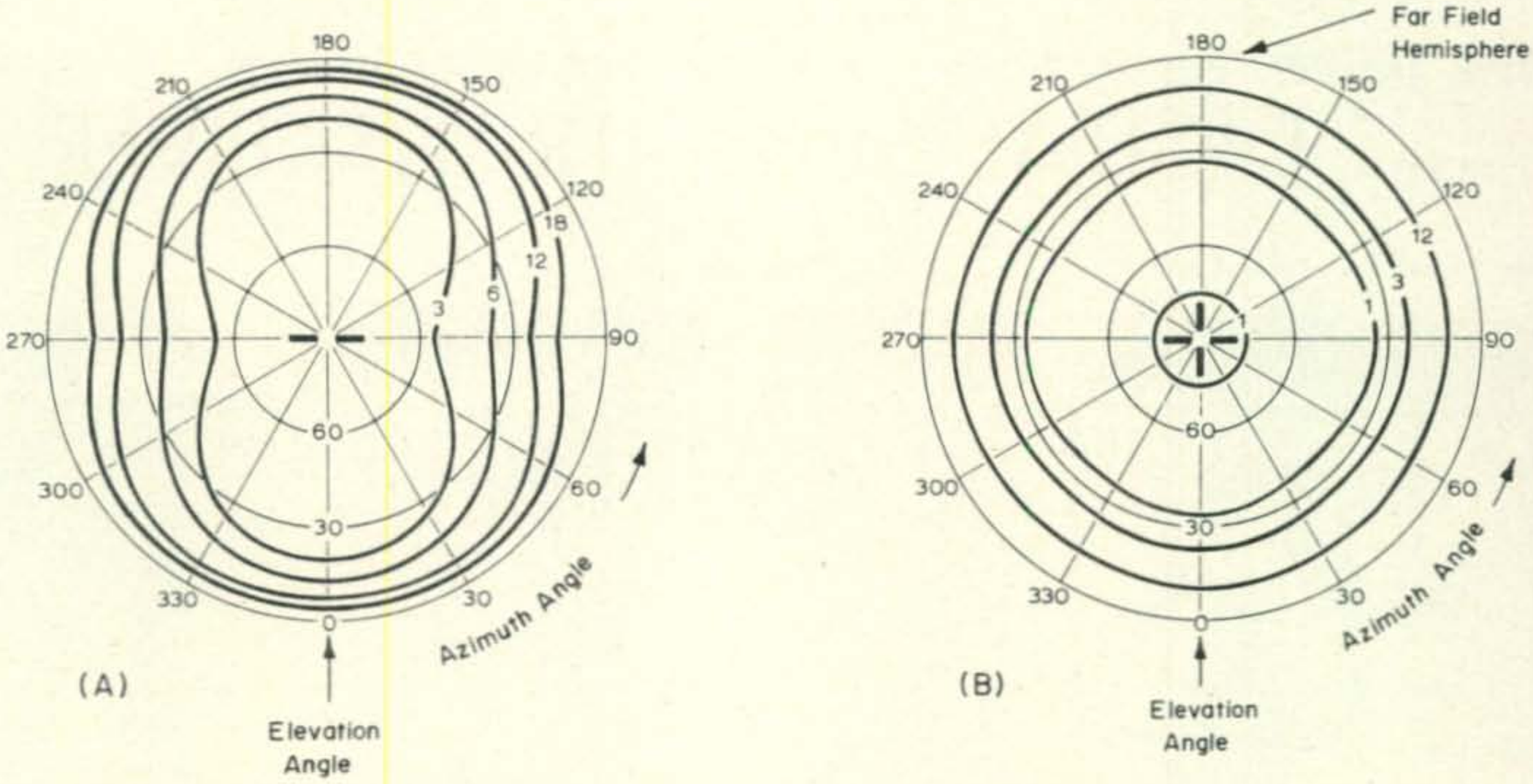

Fig. 2 — Directional patterns for horizontal turnstile (A) and dipole antennas (B) at a height of ⅜ wavelengths above perfect ground. Plan views of the antennas are shown in the center of the patterns. Contour lines are labeled in db down from the direction of maximum radiation.

of incidence and wave polarization but also the operating frequency and the electromagnetic properties of the ground viewed by the antenna. It is therefore difficult to draw specific conclusions concerning the resulting pattern without performing the numerical calculations. In general the patterns of horizontal antennas over perfect ground are an excellent approximation to the patterns found for real ground. Real ground will reduce the depth of the zenith null predicted for a turnstile installed ½ wavelength above perfect ground.

Constructional Details

A practical turnstile antenna for 10 meters may be constructed in a variety of ways. One

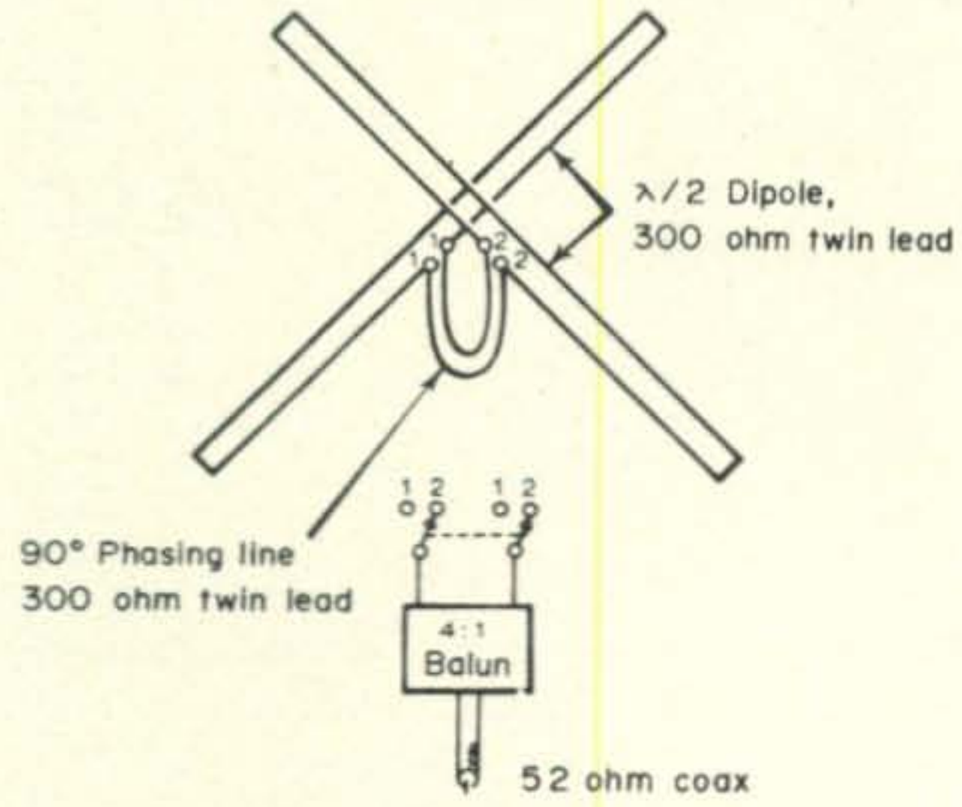

Fig. 3 — Schematic diagram of the folded dipole turnstile construction. The polarization sense of the antenna can be reversed by switching the feedpoint between terminals 1 and 2. A 4:1 balanced to unbalanced balun assists in matching the antenna to a coaxial feedline.

approach is to scale up conventional v.h.f. turnstiles by forming the crossed elements from wire or tubing. The 90° phasing line is then constructed from 75 ohm coaxial line and the resulting array can be fed directly with 52 ohm coax. Alternately 75 ohm coax can be employed as a feedline if a quarter wave matching section of 52 ohm coax is inserted between the array and the feedline.[6] From a purist point of view these traditional approaches suffer from the frequency with which balanced dipole to unbalanced coax connections are blithely soldered.

Constructional details of a folded dipole turnstile which reduces matching and transition problems are presented in fig. 3. Dipole arms and the phasing line are made of 300 ohm twin lead. A design frequency of 29.5 mHz leads to a height of about 12.5 ft, dipole lengths of 15 ft. 10 in. and a phasing line length of 7.0 ft. assuming a nominal velocity factor of 0.84. The dipoles are taped to bamboo poles which in turn are lashed to a short wooden cross arm assembly. A toroidal 4:1 balun[7] matches the antenna to the 52 ohm coaxial feedline. The v.s.w.r. of this configuration is less than 2.0 to 1 from 29.3 to 29.7 mHz. The switch shown in fig. 3 reverses the sense of the circularly polarized component directly over the antenna. The usefulness of this refinement can best be evaluated once the satellite becomes operational. ■

[6]Hodgson, J. B., *Radio Communication*, p. 432 (July 1972).
[7]Turrin, R. H., "Application of Broad-Band Balun Transformers," *QST*, April 1969, p. 42.

MORE HAM BANDS — LET'S QSY TO 30 METERS

By Gilbert C. Ford,* W7OXD

We amateurs have generally tended to look at amateur radio's future in pessimistic terms — shrinking frequency allocations, decreasing ham population, etc., etc. Personally, I think some of the best days for ham radio lie just ahead in the next two decades. One facet of this bright future as I see it is the distinct possibility of additional new ham bands and the expansion of present ones, particularly in the h.f. portion of the spectrum. Your first reaction may be that this view is wildly optimistic, but remember there once was a day when amateurs did not have the present 15 meter band. Even such conservative voices as *QST's* editor and FCC's new chief of the Amateur and Citizens Radio Division have recently suggested that new h.f. amateur bands are a distinct possibility for the future. See the November, 1971 *QST* editorial and Prose Walker's remarks as reported in the March, 1972 *QST*.

With the ever-growing use of microwaves, satellites, and cable for commercial, government and military communications, the pressure on the high frequency part of the radio spectrum (3 to 30 mHz) will grow less and less. Sooner than we may expect, the opportunity for expansion of amateur frequency allocations may be at hand.

Imagine that the year is 1980, and that a new international radio conference is being held in Geneva. The move to the more reliable satellite, microwave, and cable communication links has relieved the demands on the 3 to 30 mHz region so markedly that amateurs feel that the time is propitious for requesting additional frequencies. When this time comes, as it surely will, we must not just think of a few minor expansions of present bands, but we ought to request several entirely new amateur bands in the h.f. region.

We should begin working now towards a 1980 amateur frequency allocation such as listed in Table I. The particular set of frequencies here suggested represent slightly less than a doubling of the presently assigned frequencies in the h.f. region. Amateurs now have 12.2% of the spectrum space between 3 and 30 mHz. The proposed list would give us 22.3% of the total.

But the availability of 4 new bands would enhance the amateur's ability to communicate much more than is indicated by the approximate doubling of spectrum space. Having 500 kHz at 15 meters and 500 kHz at 17 meters is worth more than 1000 kHz at either wavelength because of the additional versatility and variety of propagation characteristics made available. When 15 meters does not open over a certain path, one might well shift to 17 meters and find the path open. Faced with the widely varying propagation characteristics of the ionosphere as produced by day to night, season to season, and sunspot cycle changes, the availability of 9 amateur bands in the h.f. region would give the amateur greatly increased communications flexibility and reliability.

The proposed new bands bear a harmonic

*415 East Sherman Ave., Nampa, Idaho 83651

80 meters	3.5-4.0 mHz
55 meters	5.25-5.75 mHz
40 meters	7.0-7.5 mHz
30 meters	10.5-11.0 mHz
20 meters	14.0-14.5 mHz
17 meters	17.5-18.0 mHz
15 meters	21.0-21.5 mHz
12 meters	24.5-25.0 mHz
10 meters	28.0-30.0 mHz

Table I — Proposed 1980 amateur h.f. frequency allocations.

Band		Dipole Length (Feet)	Quad Length of one side	
			Driven Element (Feet)	Reflector (Feet)
80 meters	3.5 mHz	134.0	70.4	72.8
55 meters	5.25 mHz	89.0	47.0	48.5
40 meters	7.0 mHz	67.0	35.2	36.4
30 meters	10.5 mHz	44.6	23.5	24.3
20 meters	14.0 mHz	33.5	17.6	18.2
17 meters	17.5 mHz	26.8	14.1	14.6
15 meters	21.0 mHz	22.3	11.7	12.2
12 meters	24.5 mHz	19.1	10.1	10.4
10 meters	28.0 mHz	16.7	8.6	9.1

Table II — Basic antenna dimensions for the proposed amateur h.f. spectrum.

Band		Length of one leg (Wavelengths)	Gain (db)
80 meters	3.5 mHz	0.75	
55 meters	5.25 mHz	1.13	5
40 meters	7.0 mHz	1.50	7
30 meters	10.5 mHz	2.25	8.5
20 meters	14.0 mHz	3.00	10
17 meters	17.5 mHz	3.75	11
15 meters	21.0 mHz	4.5	11.5
12 meters	24.5 mHz	5.25	12
10 meters	28.0 mHz	6.0	13

Table III — Gain data for rhombic antenna with leg length of 210 feet.

relationship to the old bands and to each other. This harmonic relationship is not so important from the viewpoint of transmitter design nowadays with band shifting done almost entirely by mixing instead of the former doubling or tripling, but having amateur bands harmonically related does tend to keep some excessive second and third harmonic radiation within our own bands instead of elsewhere. This advantage fails, however, at the high frequency end of each band, and completely over all of some of the bands suggested. Except for the proposed 17 meter band, the new frequencies proposed in Table I steer clear of the normal presently assigned short wave broadcast bands. This particular band request could easily be shifted to 17.0-175 mHz with practically no disadvantage to amateurs.

Equipment Requirements

If these new ham bands became available without much previous notice, the initial surge of band users will no doubt get there via converters or new crystals and coil changes in present gear, but the ham gear manufacturers would soon have a new generation of transceivers with additional positions on the band selector switch. The ham mags would be filled with conversion articles describing how to add the new bands to every conceivable type of previously existing equipment. Before long the

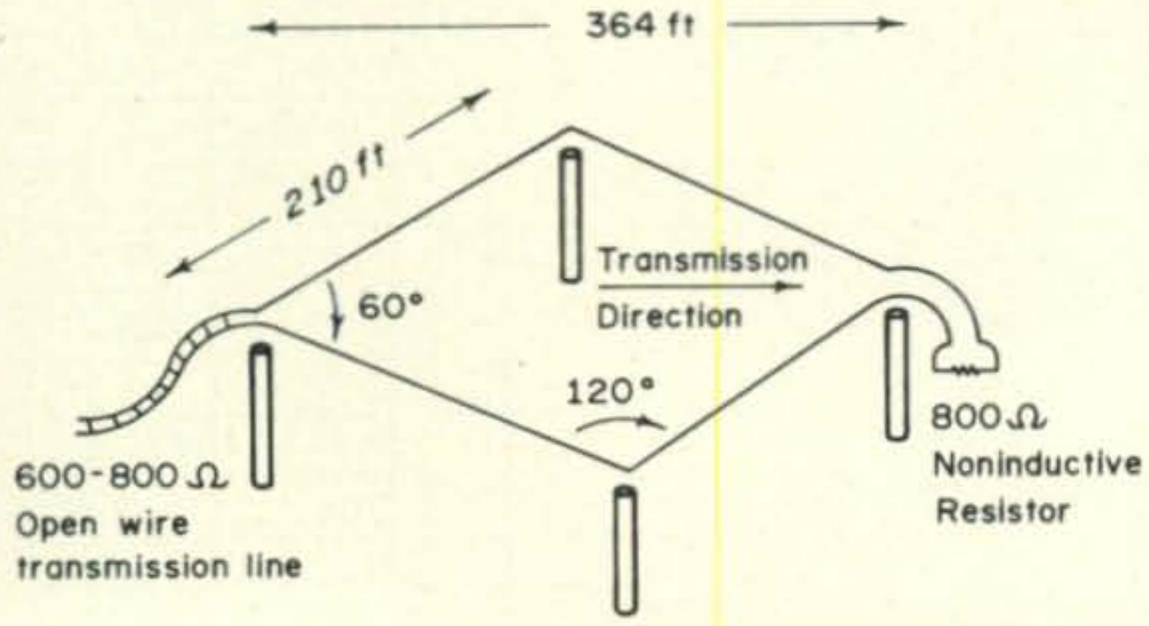

Fig. 1 — A rhombic antenna suitable for 55, 40, 30, 20, 17, 15, 12 and 10 meters.

pictures of the first 9 Band WAS winners would appear. From then on it would begin to seem as if hams had always had 9 h.f. bands.

Antennas

Although I don't recommend that you start just yet to put up antennas for the new bands, it is a fun topic to think about. Table II gives dipole and quad dimensions for both the old and new bands. A look at the numbers in Table II shows that we can expect to see a fair number of 30 meter quads. And a few hardy pioneer types will attempt to erect 6 band quads to cover 30, 20, 17, 15, 12, and 10 meters. My suspicion is that they will be at least initially markedly disappointed in the performance of such monsters. With the bands so closely spaced interactions between the elements will probably be quite pronounced. For example, a 10 meter reflector may know no better than to act like a 12 meter director.

No doubt ham ingenuity will eventually find techniques for making such a 12 or 18 element behemoth work the way a beam ought to work. The broad band frequency characteristics of the rhombic and log periodic antenna will find increasing favor with those hams having sufficient space to erect these big ones.

A nonresonant rhombic with legs of six wavelengths on 10 meters exhibits a gain of 13 db on 10 meters and 8 db on 30 meters. The gain of such an antenna on the other bands is shown in Table III.

In practice the gains given in Table III cannot be obtained from one antenna structure, since the angles shown in fig 1 would have to be varied somewhat from band to band to achieve the maximum possible gain, but a rhombic giving a gain of 7 to 10 db on all seven bands from 40 to 10 meters is quite feasible. Such an antenna is shown in fig. I.

A log periodic or transposed log periodic dipole array antenna can be built to cover the entire 10 to 30 mHz range with behavior nearly independent of frequency. Gain would typically be in the 5 to 8 db range, and the s.w.r. would not exceed 2.5 anywhere in the 10 to 30 mHz region. Such an antenna would be large, but not unmanageably so. For best performance a boom at least 45 feet long would carry some 16 or 18 elements ranging in length from 44 feet down to about 13 feet, with the element lengths and spacings varying in a logarithmic manner. Detailed theory and design information can be found in the articles listed in the bibliography at the end of this article.

[Continued on page 82]

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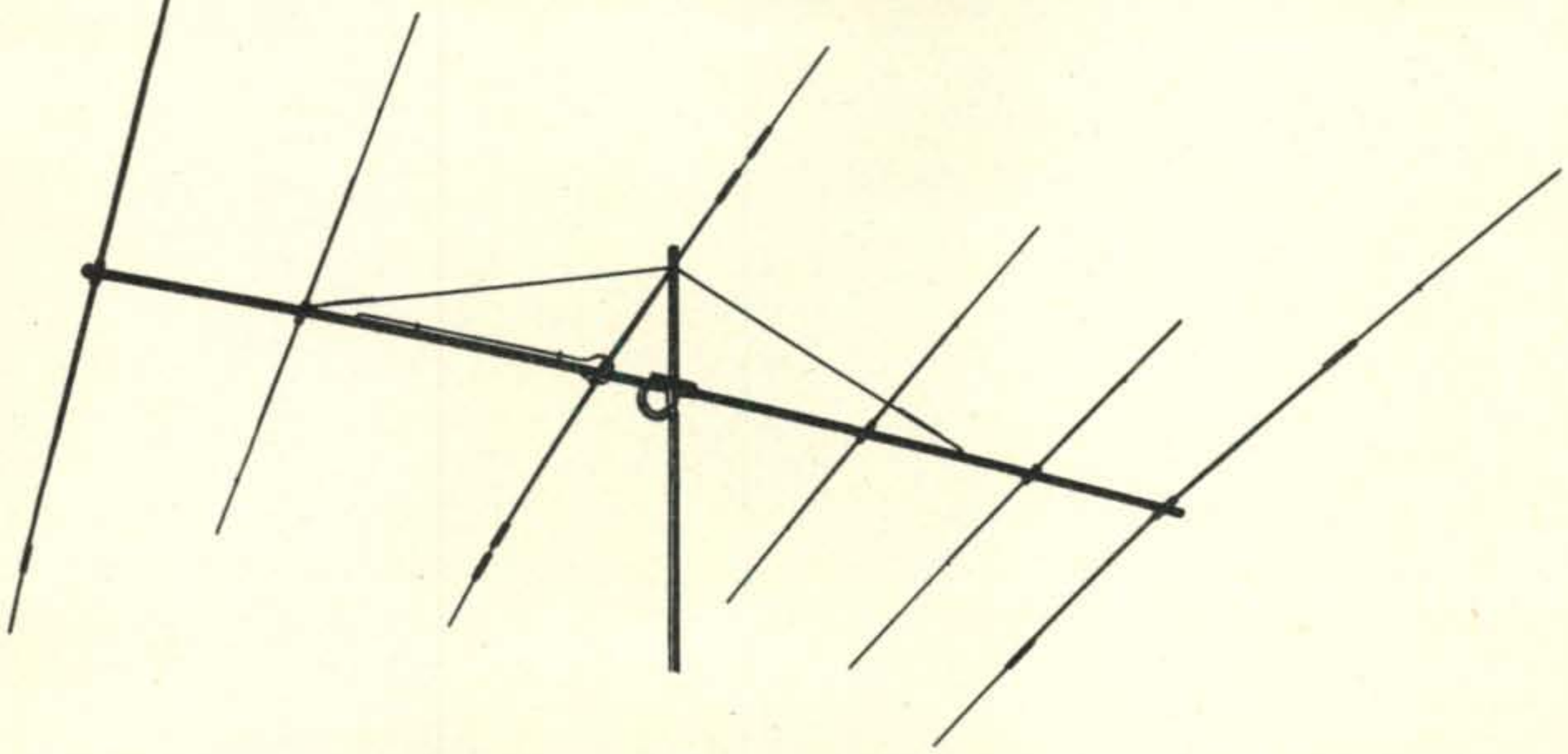

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Make Your Meter READINGS COUNT

By Ronald Sans,* WA2TCT

How much do you trust the plate current meter on your linear amplifier? Needless to say there are very few plate current meters that have the same ballistics. Most meters will read the approximate current while applying a steady-state current. But with present-day s.s.b., the meters dance all over the place. The FCC requires accurate monitoring of the average plate current; they are not concerned with the peak plate current. Since many types of meters are used, they all read different values with s.s.b. It is felt that most of the better meters read too fast, tending to read close to peak values; and thus yielding higher average current readings than are actually drawn. The circuit described below is an approach to solving this problem.

The idea is to take advantage of controlled time-constants: in this case the ¼ sec time-constant. It appears to generate a good approximation of the average current in a voice-modulated signal. The circuit also includes a peak current reading. The peak currents are measured and held for a short time: there is a fast attack and a slow decay.

Using a s.s.b. exciter without any compression or a.l.c., peak to average ratios in the order of 3 to 1 or greater are easily seen on the meter with normal speech. With exciters having a.l.c. the ratio improves to around 2 to 1. And with those that have advanced clipping and compression, it becomes less than 2 to 1 and approaches unity.

Circuit Details

The key of the circuit is the operational amplifier which is used to isolate the current from the plate supply and convert it into a signal that can be run through a shaping-network.

* 1172 Pines Lakes Drive West, Wayne, New Jersey 07470

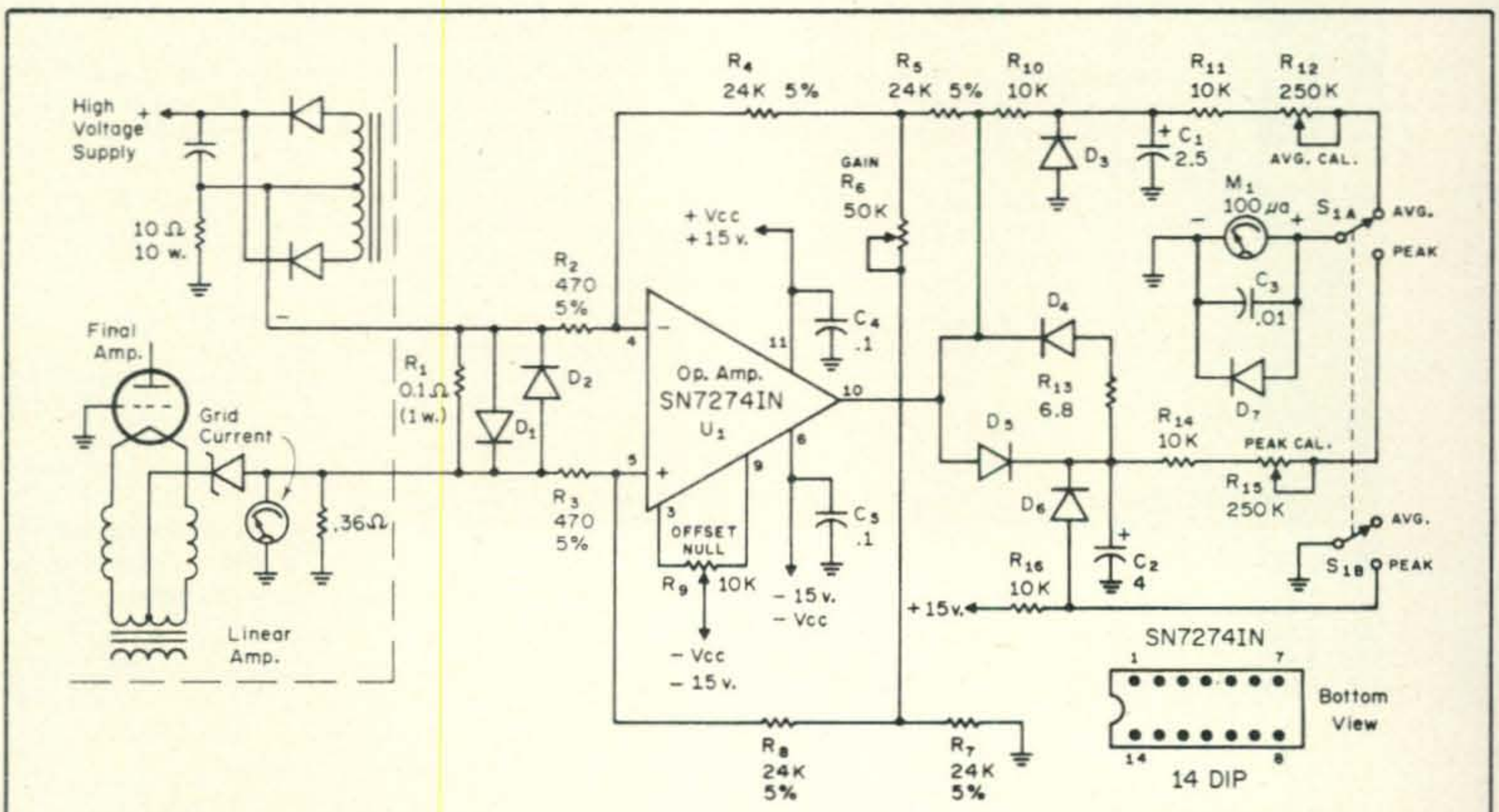

Fig. 1 — Peak and average metering circuit for use with the power amplifier of an s.s.b. transmitter. Circuit has a time constant of ¼ second and produces a good approximation of average plate current with voice modulation. All capacitors are in mf; all resistors are ½ watt 10% unless otherwise noted. D1-D7 are 1N3064 or equivalent.

The input signal is developed from the plate current across a 0.1 ohm 1% resistor, R_1. 1 a. through the 0.1 ohm resistor will yield 0.1 volts across the resistor. The diodes D_1 and D_2 are used to eliminate any spikes that might damage the op amp. Resistors R_2, R_4, R_5, R_7 and R_8 set the gain for the operational amplifier to approximately 100 to 1. R_6 will allow slight adjustments of the gain. The amplifier has a very high common-mode rejection ratio (CMRR- Rejects the grid current running between ground and R_1). The circuit is a typical differential-d.c. amplifier[1] with a high CMRR. With 1 amp flowing through R_1 (0.1 v.), one should get approximately 10 v. out at pin 10. The op amp is internally compensated; an offset null pot, R_9, is used to set the output to zero (0) volts with no current flowing through R .

Metering Circuits

The output from the op amp is fed into an average and a peak determining network. To determine the average signal, the output is fed through R_{10} and charges C, with a time-constant of ¼ sec. Resistors R and R form a voltage divider for the 100 μa taut-band meter. R_{12} is the average meter calibration pot. Diode D_7 is for meter protection.

The peak current is determined by running the output current through diode D_5 charging C_2 very rapidly. The operational amplifier's low output impedance allows it to deliver the large current necessary to charge C_2 rapidly to the output voltage. Resistor R_{14} and diode D_4 form the discharge network that discharges C_2 with a time-constant of approximately ¼ seç. Resistors R_{14} and R_{15} form the voltage divider to supply the 100 μa meter. The network D_6 and R_{16} allow diode-switching to disable the peak holding capacitor C_2 from interfering with the average reading network. The diode-switching allows the meter and switch to be mounted a good distance from the circuit.

Calibration and Check Out

First check out the power supply to make sure that you have + 15 Volts at the right pins. Put a d.c. voltmeter between pin 10 of the op amp and ground, adjust the offset null pot, R_9, for O volts output with no current flowing through R_1. Put a 0.1 v.d.c. full scale voltmeter across R_1. Turn the linear on and apply a carrier until the linear draws 0.5 v. on the voltmeter; this is equal to 500 ma through the tube. If the linear cannot stand ratings this high (most can not), use a lower current that feels safe. Adjust the output voltage (pin 10 and ground) with gain adjustment, R_6, so that there is a gain of 100 to 1: in other words, with 0.5 volts across R_1 set R_6 to 5.0 volts across the output, pin 10. This adjustment is not critical and may be changed later if the peak and average adjustments cannot be made to coincide. Next turn switch S_1 to the average position and adjust R_{12} for a reading of 50 on the 100 μa meter.

Maintaining the same current through R_1, turn S_1 to the peak position and adjust R_{15} for a reading of 50 on the 100 μa meter. This completes the calibration of the meter. In some cases the meter will not quite come to zero with no current, this is of no significance and is due to the offset not being at zero. When switching the meter between peak and average, a bounce on the meter is normal and it is due to the diode switching. ■

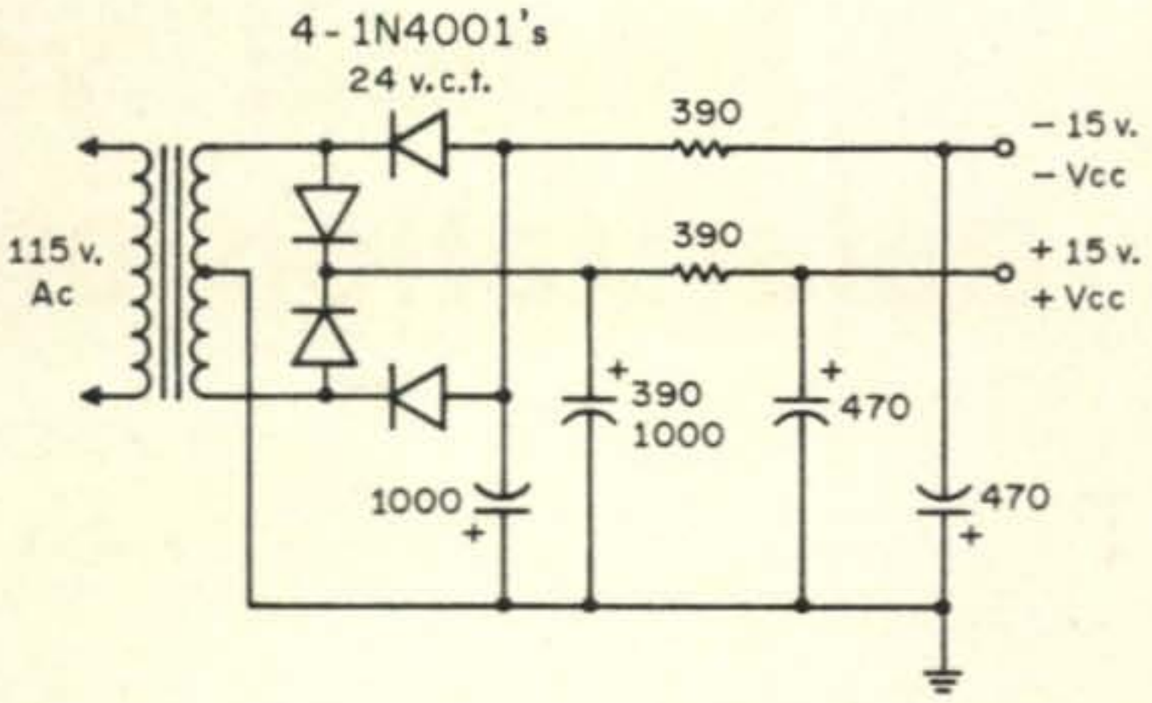

Fig. 2 — Simple power supply for the peak and averaging metering circuit, supplying both + and -15 v. with respect to ground. T_1 is a Stancor P-8394.

[1]Graeme, J. G. Tobey, G. E., and Huelsman, L. P., eds., *Operational Amplifiers Design and Application,* new York, 1971, p. 204.

The Integrated Circuits Catalog for Design Engineers, Texas Instruments Inc., First Edition:, 1972, pp. 3-34 — 3-42.

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Vertical vs. Horizontal Polarization on the VHF Bands

By John J. Nagle *K4KJ

The question of vertical vs. horizontal polarization on 6 and 2 meters has been argued for a long time and has never been resolved, if indeed it will ever be finally resolved. The purpose of this article is not to try to resolve it, but to present an explanation of why one polarization may be used in one application and the opposite polarization used in another application.

This article is based largely on an article written by Dr. George H. Brown of RCA which appeared in a 1940 issue of *Electronics Magazine*[1] and described why horizontal polarization was chosen for f.m. and TV broadcasting. Many of the assumptions are valid for amateur operations, particularly repeater work. Those who have access to back issues of *Electronics* will find Dr. Brown's article easy reading and very interesting, especially today, and I highly recommend it. After reading Dr. Brown's article I went back and reviewed the amateur literature on the same subject, and found some interesting correlations that I will also discuss.

In comparing the performance of vertical vs. horizontal polarization, certain assumptions concerning the purpose of the system and the system configuration must be made. It is the failure of some experimenters to appreciate and state the assumptions they are making that has led to so much of the static that has appeared on this subject. We begin, therefore, by making the following assumptions:

1. The transmitting antenna is high in terms of wavelength, say, five wavelengths or more.

2. The receiving antenna is low in terms of wavelength, say, less than one.

3. The noise limiting weak signal reception is manmade noise originating close to the ground, again less than one wavelength, and close to the receiving antenna, say about 100 feet. This external manmade noise is much greater than the internal receiver noise.

4. We also assume that the earth is flat as this considerably simplifies the mathematical calculations. The effect of the flat earth assumption is to restrict the validity of the results to the horizon, eliminating long-haul DX and propagation by mechanisms such as ducts, inversions, aurorae, etc.

These assumptions fairly accurately describe the typical urban f.m. TV broadcast situation: a high transmitting antenna in the clear and a low receiving antenna in a noisy environment. These same assumptions also fairly accurately describe many amateur situations such as the repeater-to-mobile link. The repeater uplink, mobile-to-repeater, requires a slightly different set of assumptions and will be discussed later.

I will first discuss the ratio of vertical-to-horizontal field intensities F_vF for various transmitting and receiving heights, expressed in wavelengths. These data are taken directly from fig. 4 of Dr. Brown's article and represent the results of theoretical calculations which were verified by actual field strength measurements at frequencies of 47 and 100 mHz. These ratios are given in Table I.

The important thing to recognize is that when both transmitting and receiving antennas are low there is a big advantage to vertical polarization. In fact, when both antennas are on the ground

$$\left(\frac{h_t}{\lambda}=\frac{h_r}{\lambda}=0\right)$$

vertical polarization is 23 db better than horizontal. However, when the transmitting antenna is high and the receiving antenna low

$$\left(\frac{h_t}{\lambda}=100 \text{ and } \frac{h_r}{\lambda}=1\right)$$

the advantage of vertical polarization drops to only about 1 db. Since the laws of propagation are bilateral, the same results would be obtained if the transmitting antenna were low and the receiving antenna high, the mobile-to-repeater link. In other words, vertical polarization gives a very slight propagation advantage when one antenna is high and the other is low and a very definite advantage when both antennas are low. Bear in mind that we have not discussed the case where both antennas are high; please do not extrapolate these conclu-

---

* 12330 Lawyers Road, Herndon, Va. 22070

[1] Brown, G. H., "Vertical vs. Horizontal Polarization," *Electronics*, Oct. 1940, pp. 20-23.

Receiver Antenna Height in Wavelengths; $h_r \div \lambda$									
ht	0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
0	23	23	23	23	23	23	23	23	23
0.1	23	18.5	17	16.9	16.7	16.5	16.1	15.8	15.5
1.0	23	18.3	8.3	6	5.3	4.6	4.3	4.0	3.8
10	23	10.3	6	4.4	3.3	2.3	1.9	1.2	1.1
100	23	10.2	5.8	4.2	3.1	2.1	1.7	1.0	0.85

Table I — Advantage in db of vertical polarization over horizontal polarization, for various transmitting and receiving heights. Data taken from fig. 4 of Reference 1. Height of receiving antenna in wavelengths and $h_r \div \lambda$ height of transmitting antenna in wavelengths.

sions, or other conclusions that follow, to the both-antennas-high case.

So much for signal levels; we will now consider the other parameter that limits communication, noise. In this discussion we will make the following assumptions concerning the characteristics of the noise:

1. The predominant noise is manmade and generated close to the ground.

2. The external noise level is considerably higher than internally generated receiver noise.

3. The receiving antenna is relatively low to the ground.

4. The noise source generates equal energy in the horizontal and vertical noise components. In this assumption, notice that we have not said that the horizontal and vertical components of noise are equal at the receiver; only that the noise source has equal energy in the horizontal and vertical components. This is an important distinction!

Now let's see what happens as the noise propagates to the receiver. In the previous discussion we said that when both transmitting and receiving antennas were close to the ground, vertical polarization offered considerable advantage over horizontal; up to 23 db, in fact. For the same reasons the vertical component of noise will be stronger at the receiver than the horizontal component.

The fact that vertically polarized antennas pick up more noise than horizontally polarized antennas is well known to most amateurs. E. P. Tilton[2] comments on this in an article in QST in 1956. As early as 1932 Anderson and Lattimore reported[3] that radiation from motorboat ignition systems appears to be largely vertically polarized. From my own experience this type of noise appears to peak up in the 30-40 mHz region affecting amateur mobile operations on the 10 and 6 meter bands the most.

We thus have a situation where the horizontal component of noise is considerably reduced below the vertical noise component, but the horizontal component of signal is only slightly reduced from the vertical signal component. The result is an improvement in the signal-to-noise ratio for the case under consideration: namely, transmitting antenna high, receiving antenna low, and the predominant noise, manmade and low. This is the situation in f.m. TV broadcasting and is the reason v.h.f. broadcasting is horizontally polarized. The assumptions made for v.h.f. broadcasting also apply to the repeater-to-mobile link (or downlink) used by amateurs.

Now, before *CQ's* readers jump to the conclusion that K4KJ advocates horizontal polarization on 2 meter f.m., let's describe two other cases dear to the hearts of f.m.-er's. First is the mobile-to-repeater link and second, the mobile-to-mobile link.

The situation corresponding to the repeater uplink with the transmitting antenna low and the receiving antenna high was not considered by Dr. Brown since he was mainly interested in the v.h.f. broadcasting case. However, we can take the available facts and analyze this situation ourselves. In the previous description we noted that when one antenna was high and the other low, vertical polarization gave a slight advantage over horizontal and that it did not matter whether it was the transmitting or receiving antenna that was high or low. We do not have to change our thinking as far as the signal propagation is concerned. We do have to change our thinking concerning noise characteristics, however.

Receiver sites are usually selected for their noise-free environment and the antenna is as high as possible away from sources of man-

[Continued on page 84]

[2] Tilton, E. P. "Polarization Effects in VHF Mobile," *QST*, XL, 12, Dec. 1956, pp. 11-13.

[3] Anderson and Lattimore, "Operation of a Ship-Shore Radiotelephone System," *Proc. IRE*, 20, 3, March 1932, pp. 407-433.

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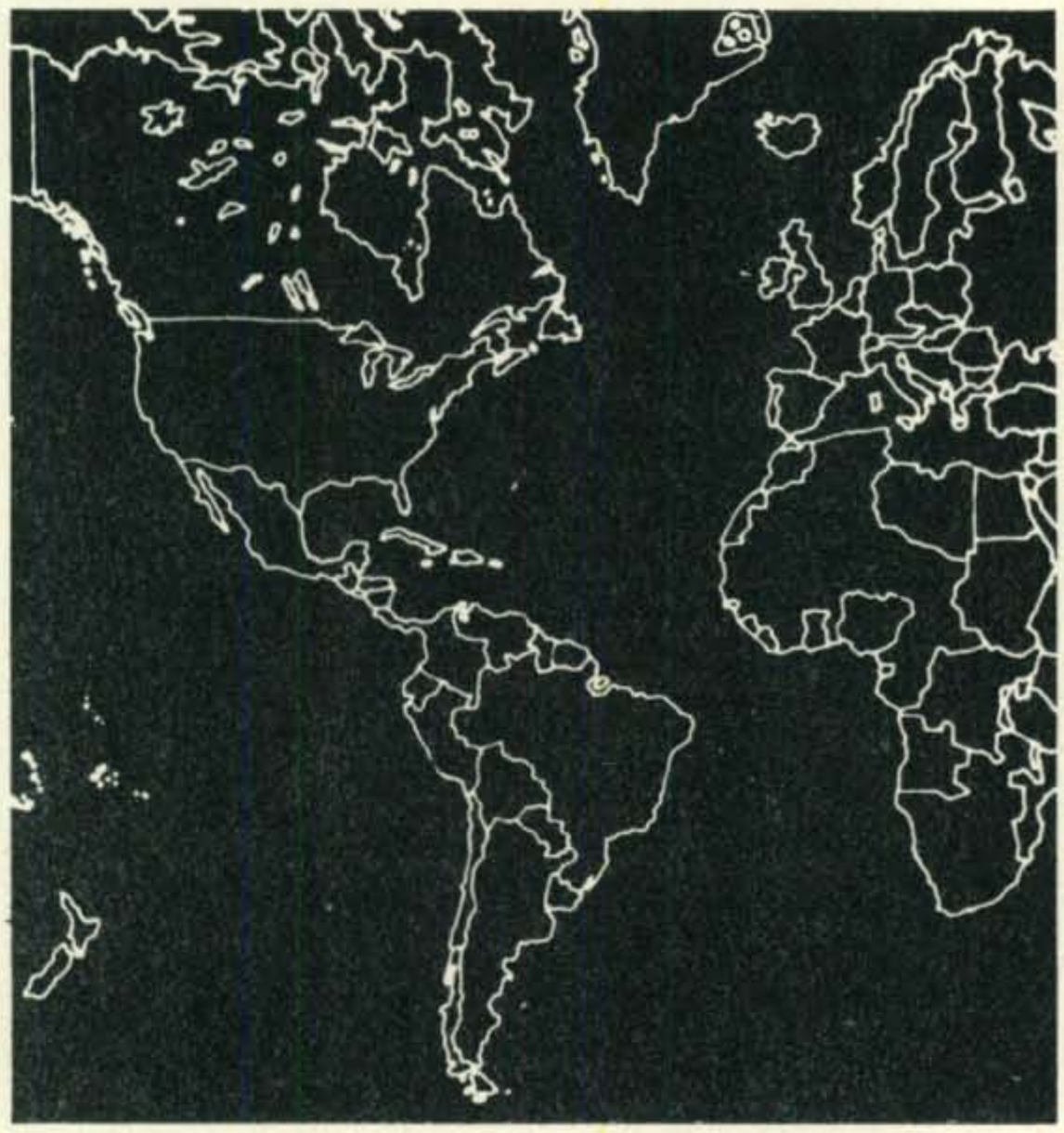

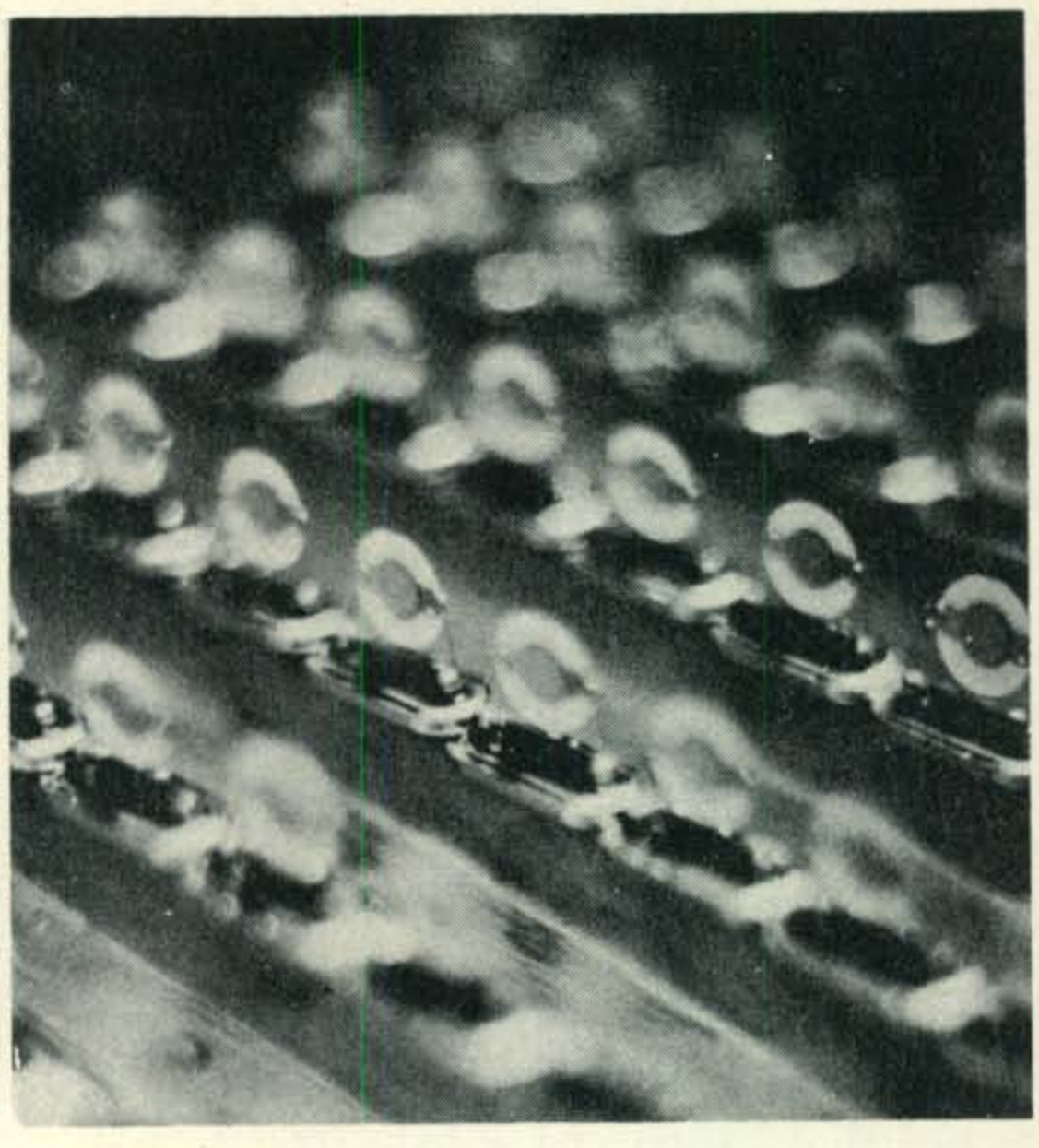

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F. M.

BY GLEN E. ZOOK,* K9STH/5

IT'S quite easy to get into a rut and carry on and on about what is wrong with f.m. these days. So, for a change, lets digress a while and take another look at what is right.

First of all, f.m. has put new life back into amateur radio. The fun of operating for operating's sake can be found more readily in f.m. than any other mode. Repeated contacts with locals and occasional jaunts around the country to make new friends are one of the great calling cards found in our special mode. The number of old-timers back on the air using f.m. is astonishing, as is the growing number of converts from that (please excuse the term) other service called CB. The sale of equipment to the v.h.f. f.m. operator has made amateur sales again profitable to wholesale and retail outlets which virtually forgot amateur radio due to lagging sales. Also, firms which, it seems, had almost forgotten amateur radio are again striving for the top share of the growing f.m. market.

Next, f.m. is the place for experimentation. Not only is f.m. a voice mode, it can be used as a medium for all sorts of specialized communications such as SSTV, FAX, tone controls, and many others. The complexity of control functions and operating possibilities in some amateur repeater systems put many commercial systems to shame. Although the r.f. portions in many systems consist of older commercial equipment, the accessory portions contain the latest solid-state technology. In other systems the r.f. portions are also completely designed and constructed by amateurs. Such cannot be said of operations using other modes.

Finally, f.m. comes through in emergency and public service communications when other modes and services don't quite make it. The nature of v.h.f. f.m. is such to provide almost perfect coverage of localities that lower frequencies cannot hope to cover. The absence of noise and the better equipment employed by amateur f.m. operators gives still another edge. And, finally, the greatly extended coverage rendered by the repeater puts the frosting on the cake. All that is needed is for an emphasis to be placed on getting mobile and portable repeaters ready for going into a disaster area. This is the next logical step for expanding the capabilities of amateur f.m. operations.

*410 Lawndale Drive, Richardson, Texas 75080.

Frank K5VQY and Ted W5PCX keep those talks going. *(WA5KHU photo)*

Texas VHF FM Society

The summer convention meeting of the Texas VHF FM Society was held August 12 through 13 at the Villa Capri Hotel in Austin, Texas. Several sessions, both business and technical were held during the two day meeting. The first session was spearheaded by Doug Blakslee, W1KLK, of the ARRL Technical staff. Doug put on one of the best technical discussions this columnist has seen at any amateur meeting. The topic was f.m. receivers, with lots of the nitty-gritty about possible problems and cures.

The Texas group is famous for its late night technical discussions and the 1972 meeting was no exception. The topic for the evening informal session was the TIRS or Texas Inter-city Relay System program. TIRS is a long-range program intended to link the

The Texas VHF FM Society technical discussions run well into the wee hours of the morning. Here (left to right) W5VCE, WA5OFH, K5VQY, and WA5CJG, undertake some high level discussion of the TIRS program. *(WA5KHU photo)*

Roy Albright, W5EYB, West Gulf Division Director and his XYL make all the Texas VHF FM Society meetings. It's sure nice to have friends in Newington! *(WA5KHU photo)*.

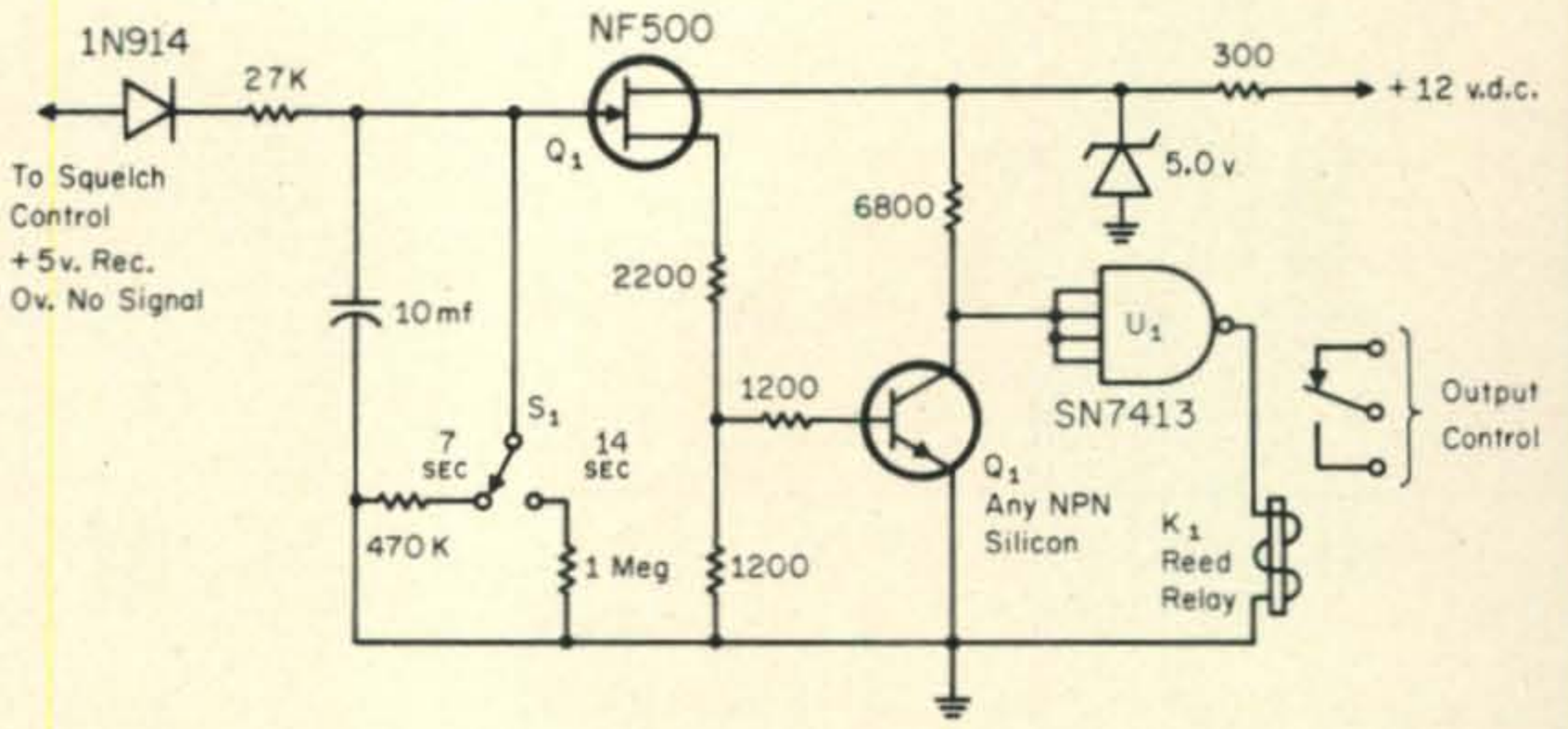

Fig. 1 — Monitoring tape recorder control built by G4 IGX designed primarily for use with the IC-20. S, controls the shut-off delay. O, is any inexpensive FET; Q is any NPN silicon Transistor.

coastal cities (with a long history of natural disasters) with the interior (such as Austin, San Antonio, Dallas) when needed. 450 mHz links with coded interconnect terminals are the heart of the system. Bob Pace, WA5CJG, along with W5FUA and K5CFQ (among many) are progressing quite well with the control and terminal circuitry. Any repeater group in Texas interested in being a part of TIRS should contact Bob directly.

Finally, the Sunday portion of the convention was the business meeting. Therein it was announced that the new Society Constitution has been accepted unanimously by a mail vote and only one dissenting vote to the By-laws (someone mentioned checking that Zip Code, hi.) Other topics included acceptance of a budget, election of three directors, and the presentation of the *QST* cover award for May to W5NSQ for the article on the Texas 2 meter band plan. The next meeting will be in February at a site to be firmly announced later.

Loyalties

A number of amateurs have asked this columnist why articles written by him have appeared in another publication, namely *73*. The answer is quite simple: I got my start in the amateur writing game writing for *73*, and, before taking the assignment as FM Editor of *CQ*, wrote many articles for publication in *73*. These articles were paid for and became the property of that publication. Many of those articles had not been published prior to the creation of this column. Therefore, Wayne Green has every right to publish those articles. As far as I know, there is no bad blood between Wayne and myself. We don't always agree on policy matters, but remain on a cordial basis. The same goes with the editors and publishers of other amateur magazines. I don't believe in letting personalities into print. Enough said!

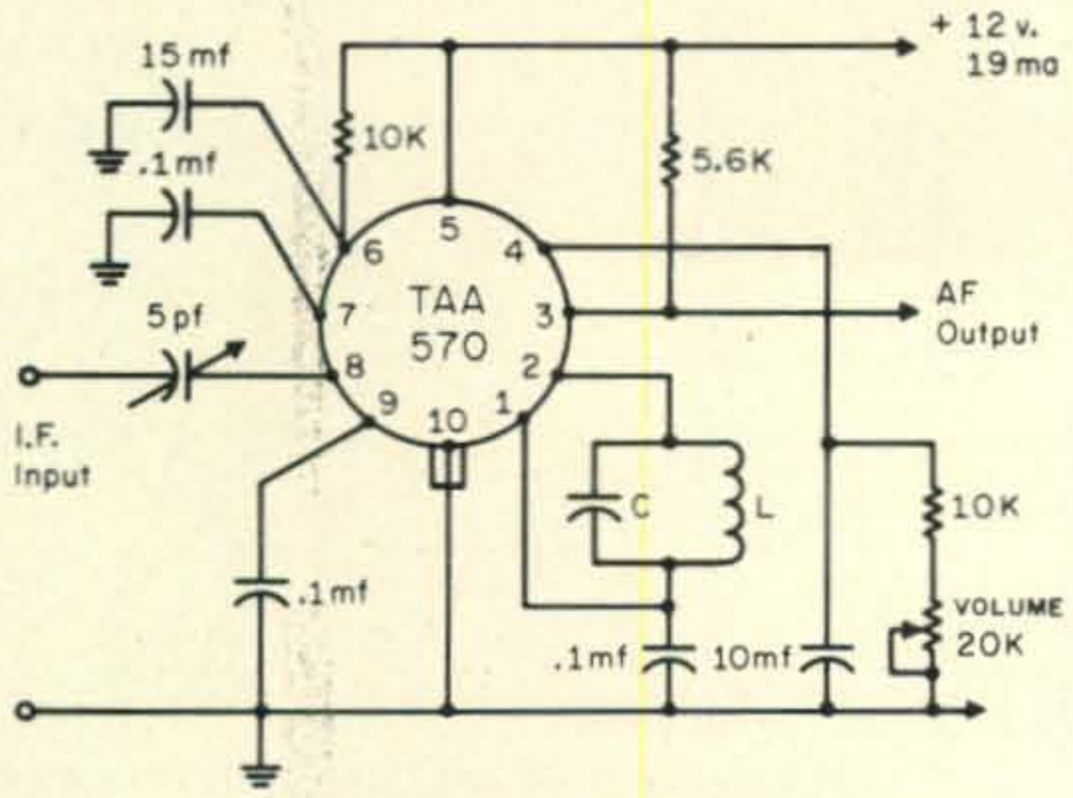

Fig. 2 — F.m. detector using the Amperex TAA-570 quadrature detector IC. Operating frequncy is determined by C and L. (Built by G3SHK).

Technical Talk

The integrated circuit multi-frequency deck is undergoing major design changes, so will have to put it off for a month or so. In fact, two different approaches are now being taken, giving a possibility of several different deck designs.

So, for this month's Technical Talk we must go to another group of reader submitted circuits. The circuits for November come from the United Kingdom via Karl, G5AGX. The first circuit is one that Karl is using for a COR on his IC-20, but can probably be adapted to the other solid-state import rigs as well. Control of a tape recorder for monitoring a channel was the original idea, but the circuit can be used to control just about anything including the push-to-talk circuits of a transmitter.

The second circuit is an add-on f.m. detector circuit using the Amperex TAA570 integrated circuit. This circuit is the brainchild of G3SHK and was passed through the bulletin of the U.K. FM Group (London) via Karl. Although the TAA570 is a quadrature detector, excellent results were experienced by the U.K. f.m'ers with about 100 millivolts of audio output from the I.C. at + 5 KHz deviation. Since the operating frequency of the detector is determined by an LC circuit and not by a discriminator transformer, the circuit should be quite useful in convertor-receiver combinations such as the Heath SB and

[*Continued on page 86*]

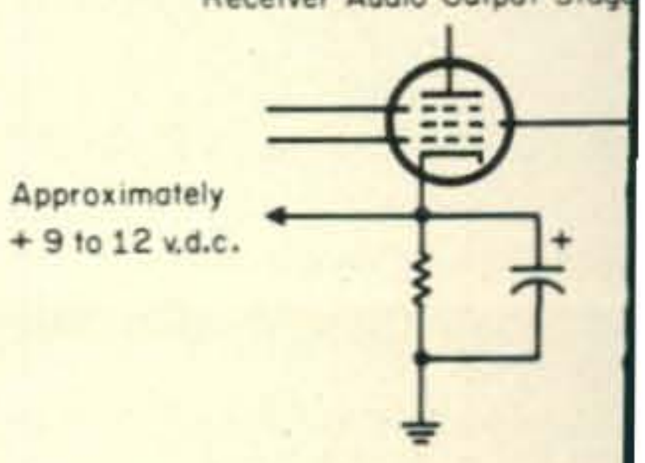

Fig. 3 — D.c. voltage for running solid-state preamplifiers can often be obtained from the cathode of the receiver audio output stage.

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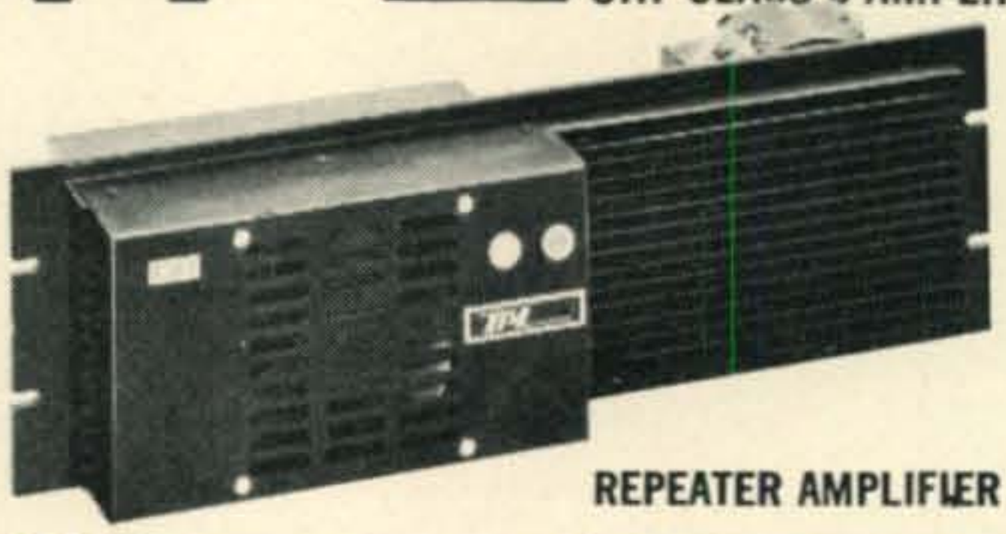

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PA3-1AC	1-5W	35-50W	"	PA3-1DE	5-15W	80-120W	"
PA3-1DC	6-15W	30-55W	"	PA6-1DE	1-4W	20-30W	400-512MHz
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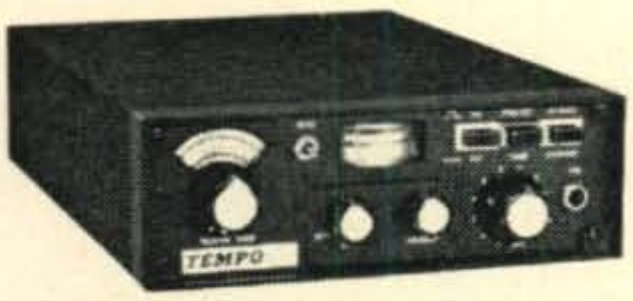
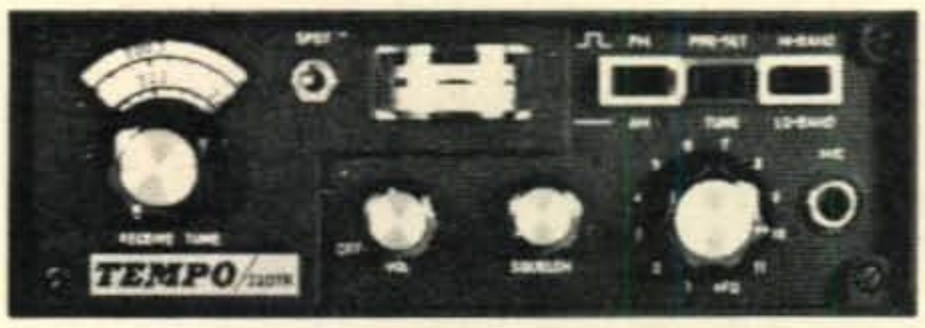


TEMPO/220 TR



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Getting An Edge On That Amateur Extra CW Examination

By Al D'Onofrio, *W2PRO

Are you interested in getting an honest and meaningful edge in passing that forthcoming 20 w.p.m. Amateur Extra examination? Getting an edge — even a little psychological edge — often spells the difference between success and failure. And getting that little edge requires hardly more than a generous amount of common sense, and you now have that. So let's look at this 20 w.p.m. exam in the cool light of common sense, and look for ways that may afford you an edge in preparing for and taking that test.

First off, recognize that fear is your No. 1 enemy. Fear creates stress, and stress creates mistakes — and there's enough room for honest mistakes to be made, without your creating a few extra ones. Rid yourself of that misplaced burdensome fear and you have the biggest edge anyone taking an examination could ask for.

As far as your 20 w.p.m. exam is concerned, you rid yourself of that fear by preparing for the examination under common-sense simulated test conditions — just as the astronauts had done in preparing for that giant step for mankind on the moon. They trained for their final examination by simulating, as far as practicable, the conditions under which they would have to function.

For them, stepping onto the moon must have seemed almost a technicality — they had made the voyage hundreds of times; any unreasonable apprehension they may have had at the beginning of the lunar project had long since been replaced by confidence in themselves, in their craft, and in their support team. They gained this unbeatable confidence through simulated training exercises.

By training under simulated conditions, you will be able to function successfully later under real conditions; the two conditions will be almost identical. The result of all this is that unreasonable apprehension is replaced by confidence in your ability and a relaxed cool-headed frame of mind; fear and stress are well under control.

Preparing for the C.W. Exam

You want to simulate, as far as practicable, the c.w. copying speed and conditions under which you will be taking your examination. You want to immerse yourself in a solid 20 to 25 w.p.m. atmosphere, the kind of c.w. that W1AW puts out in their code practice sessions. Copy keyer QSO's in this 20 to 25 w.p.m. range, too. Shun the slower and faster speeds during your training sessions, and especially avoid any Lake Erie Swingers at any speed — even though they are great rag chewers. While in training, you will keep company with only the best.

If you can afford it, buy or rent a good tape machine with a variety of straight text tapes. The big advantage in using a tape machine is that it puts out the kind of c.w. you'll be copying during your examination.

Be methodical in your training: copy regularly, but not longer than 30 minutes at a sitting. Accept the fact that there is a gestation period for increasing your copying speed — so don't try to hurry things too much.

Do not waste your time trying to learn the more exotic punctuation marks and ham lingo type of abbreviations; the usual ones — period, comma, diagonal, and question mark — will suffice. For the most part, the c.w. you will copy in the examination will be straight down the middle of the road English, without detours.

A cardinal rule: use standard headphones while copying, preferably without ear cushions. You will be wearing them during the examination, so you might as well get used to them.

Remember, there will be others in that examination room besides you, such as those taking their commercials. Inevitably, you will have to contend with unavoidable distractions from this human activity. Consequently, do not insist upon Studio One copying conditions at home. Accept a certain amount of room QRM as part of the challenge.

Copy on standard 8½ x 11-inch ruled paper, the kind with that cardboard in the back. Whatever you are writing with — pen or pencil — stay with it; nothing is more distracting than trying to copy in pencil what you have been copying for weeks in ball-point pen.

As an aside, try experimenting with different copying styles. For example, I have found that writing in well-rounded letters is easier than writing in small letters: the larger script reduces tension. Others release the pen

*1537 Central Park Ave., Yonkers, New York 10710

from the paper after each letter, using extra wide spacing between words. Whatever copying style keeps you relaxed is the one to stick with.

How do you know when your c.w. copying speed is good enough for the examination? Consider your c.w. exam-ready when you can copy on paper 25 w.p.m. for one minute. Although you may be able to handle 20 w.p.m. without error for more than a minute, don't bank on being able to do it under stress. Leave yourself a 5 w.p.m. margin of confidence to compensate for that normal amount of stress and anxiety we all experience when we are being put to the test.

Don't make the mistake in waiting too long before you take the examination, thinking that if 25 w.p.m. is good, then 30, or 35 is better. What happens, ironically, is you run the risk of becoming psychologically overtrained. Believe it or not, I have known hams — QRQ operators today — who honestly admit to having flunked their first try out, because they became flustered trying to copy at that slow-poke 20 w.p.m. When you can copy a solid 25 w.p.m. — you're ready.

A word about sending c.w. is in order. The easiest way to master good sending is to hook up a straight key and send in step with W1AW at 20 w.p.m. One secret to developing a good fist is having your key adjusted properly: close spacing of the contacts (no wider than the total thickness of a couple of sheets of paper) the weak spring tension; the rest is all the wrist. Personal preferences on these adjustments often vary from one operator to the other; therefore, experiment until you find the set-up that is easiest for you to send clean 20 w.p.m.

During the sending part of the examination, the inspector samples the accuracy of your c.w., but rarely for a full minute's worth. At this point, he is like a doctor taking your pulse for 15 seconds, and based upon his judgment, multiples times four.

You may opt to take your electronic keyer along instead of using the straight key. Choose whatever you feel gives you the edge.

Here is one of the most beneficial pre-test edges of them all: on the day of the examination, copy for at least 20 minutes before leaving the house. This last minute sprint of c.w. will keep your confidence level high, and help maintain the proper physical and mental attitude. In some respects, it's similar to the relief pitcher in the bull pen, working right up to the minute he's called to the mound.

Don't hurry on your way to the FCC examination site. Examination hours are usually flexible, enabling you to saunter in any time before 12:00.

If, along the way, you feel yourself becoming too tensed up, stop for a leisurely coffee break; you're not working against a stopwatch.

Taking the C.W. examination

In the examination room, select a seat that best suits your immediate needs and temperament. For instance, if you subconsciously feel uneasy about looking at that tape machine, which to you possesses all the affection of a sleeping cobra, then select a seat far away from it. Give yourself the edge.

Stay away from the doorway areas and opened windows. There's too much activity near the doorway, and a sudden blast from a truck air horn from the street could swamp your best copying efforts.

Once seated, adjust your straight key and send something — an SOS is always appropriate at such times. Someone will answer your call with laughter. The object is to loosen up, relax those facial muscles. Yawn, stretch your arms, wiggle in your chair, chat with your neighbor about how these keys feel strange. He'll welcome the chance to chat with an old friend. Relax . . . relax.

With the preliminaries completed, comes the piece de resistance — the 20 w.p.m. receiving examination. The inspector will offer you a pad or a sheet of paper to write on; ask him for another sheet of paper, just in case. I'm probably the only ham who ended up handing in one sheet of copy plus the cardboard backing, written on both sides. A little longer and I would have handed in the table top.

When he starts the tape machine, take a deep breath for courage, and copy everything you hear — even the series of V's that usually precede the actual text. Copy as best you can, remembering that you need to copy only one-minute's worth of test out of a total of five minutes — you need only to copy 20% out of the total sent. Now, how generous can those FCC fellers get.

Suddenly, without warning, you're copying an AR: the receiving examination is over. Use the next minute to good advantage by quickly looking over your copy, crossing those T's and dotting those I's. The copy is still yours until you've handed it to the inspector.

While your received copy is being checked by an inspector, another may administer the send-

[*Continued on page 84*]

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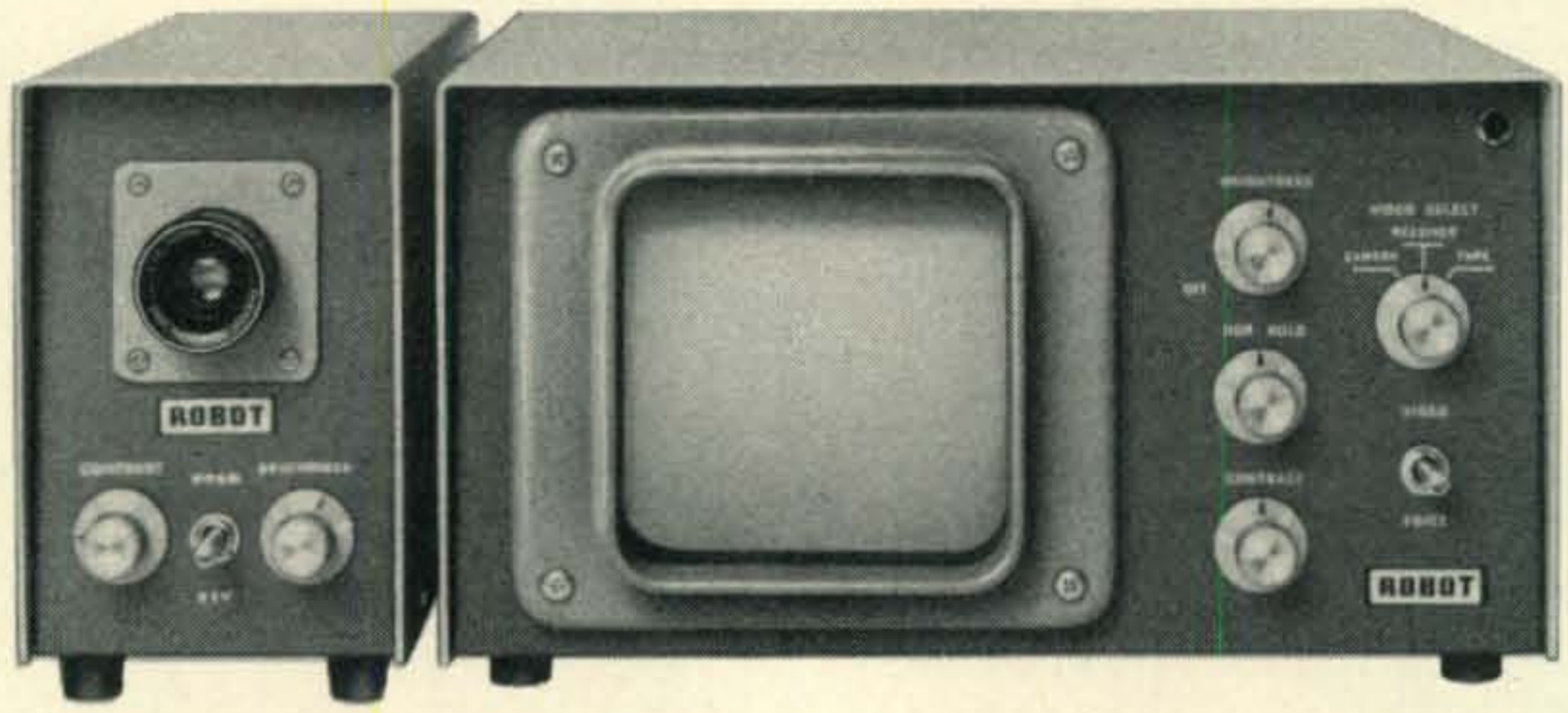

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Slow Scan TV

By Copthorne Macdonald,* W1GNQ

Last month we explored the concepts of geometric distortion and picture resolution as they pertain to SSTV. This month we'll continue to look at the problem of evaluating SSTV gear by focusing our attention on some of the other aspects of monitor performance.

Limiters

In a slow-scan camera or FSS the brightness variations in the scene are converted into frequency variations of an audio subcarrier. What this really means is that we have encoded our brightness information in such a way that the time duration of ½ cycle of subcarrier tells us the brightness of the particular picture element being scanned during that half cycle. The first step of the decoding operation in the monitor is to pass the incoming signal through a limiter. The ideal limiter gives square wave output of constant amplitude regardless of the input amplitude, and a time between axis crossings exactly equal to that of the input signal. (The "axis crossing" is the zero voltage point where an a.c. signal goes from plus to minus, or minus to plus.) No real-world limiter is perfect, but some are lots worse than others. You can tell a lot about a limiter by feeding a low distortion sinewave into its input and observing the limiter output on a scope. Over what range of input level does the output amplitude remain constant?, is the first question to ask. How does this range of audio level compare with your receiver output level? During fast fading conditions the receiver a.g.c. does not react quickly enough to keep the receiver output constant. Dips in audio level down to 30 db below normal are quite possible. There might be perfectly useable information in that -30db signal, but if the limiter no longer limits, that information will never appear in the picture.

The second major limiter problem is that of second harmonic distortion; and it too can be detected by feeding a good sinewave in. Here, the output square wave is not square. The positive half cycles are all appreciably longer or shorter than the negative half cycles. Sometimes this unbalance occurs at all levels of input voltage, sometimes only at high or low input levels. With second harmonic distortion present, the low pass filter which follows the discriminator output rectifier is now called upon to eliminate the subcarrier frequency itself rather than just the subcarrier harmonics. Inadequate filtering can result in a "dot" pattern on the screen. There are other possible causes of such a dot pattern, the most likely of which is second harmonic distortion in the video detector driver amplifier (in monitors which amplify the discriminator a.c. output and rectify right at the CRT grid).

Grey Scale

A television system, in addition to producing a monitor picture that is geometrically faithful to the original scene, should also maintain fidelity with respect to the relative brightness of various parts of the image. The human eye has a logarithmic rather than linear sensitivity characteristic. Man is able to cope with a tremendous range of light levels. A sheet of white paper in the noon sun has roughly 10,000 foot candles falling on it. On a moonless night, far from a city, the incident light is about one millionth of a foot candle, yet the eye can spot the piece of paper in both instances, if it has time to become adapted to the light level present. On that moonless night the stars appear very bright, yet we know that we cannot see them in the daylight even though they are shining just as brightly. Our eyes just can't detect an incremental brightness increase if it is small compared to the overall brightness being experi-

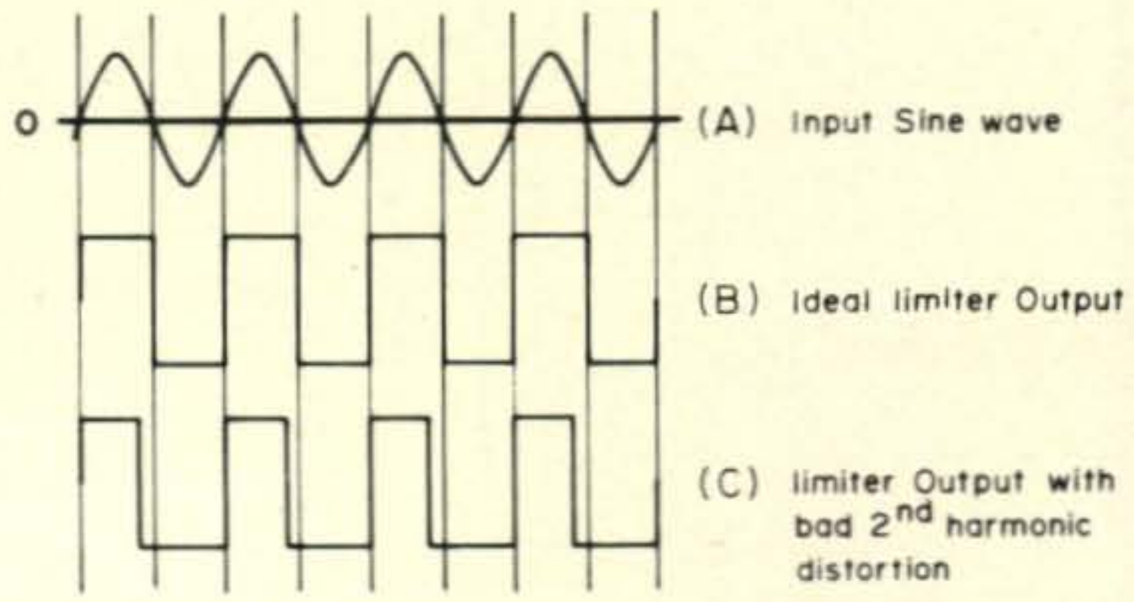

Fig. 1 — Limiter performance, with and without 2nd harmonic distortion.

*P.O. Box 261, Forest Part Station, Springfield, Mass. 01108

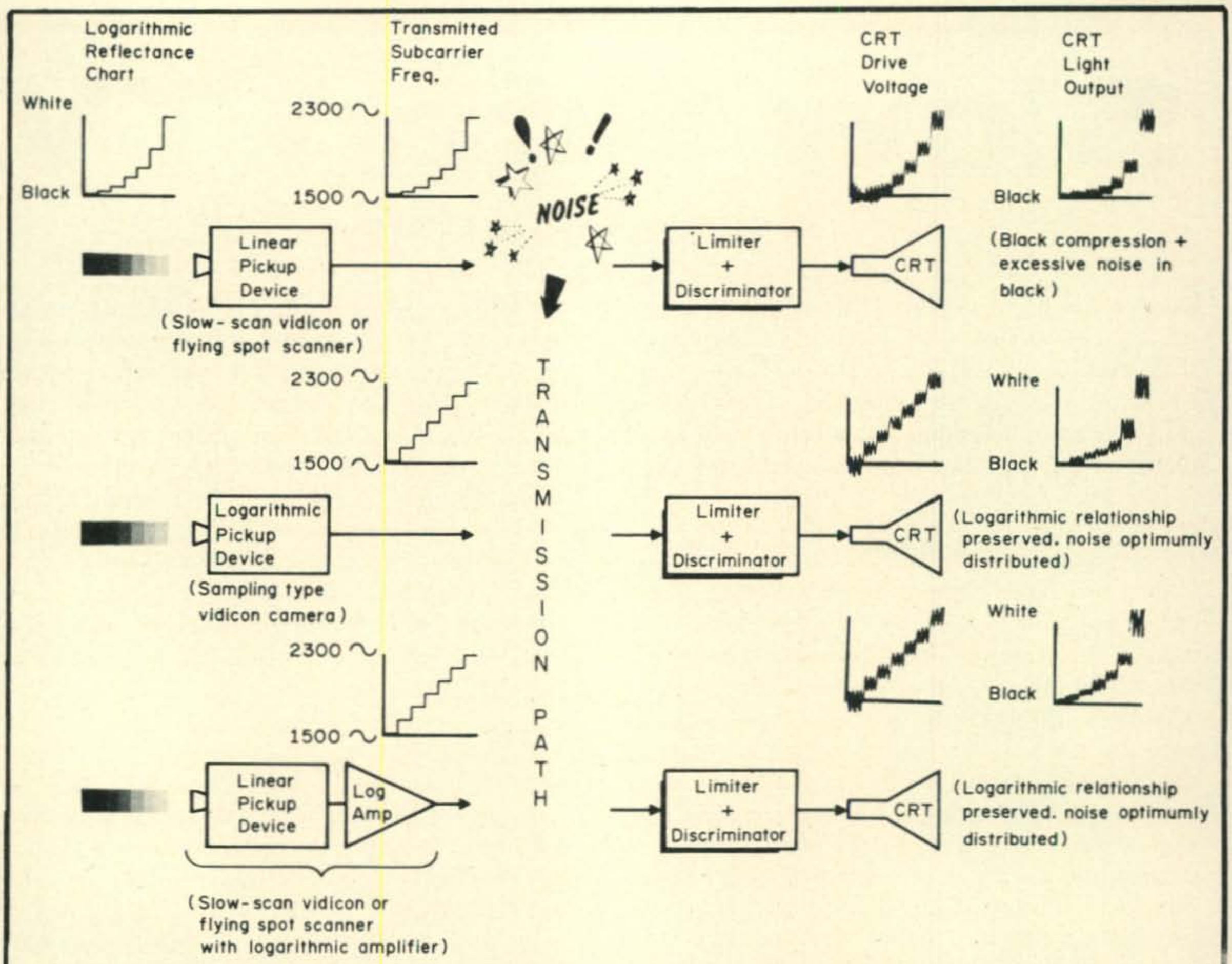

Fig. 2 — System grey scale performance for various image pickup schemes.

enced. An audio level must be increased 1 db, (a sound power *ratio* of 1.26) to be detected as an increase in loudness. In the same manner, brightness must be increased by some minimum *ratio* to be detected as an increase. An *added* brightness of one foot candle would be considerable if the initial brightness is only one or two foot candles. Add one foot candle to 1,000, however, and you'd never notice it.

Grey scale charts are made in two varieties; linear and logarithmic. The linear chart generally has 10 steps, with reflectance in 10% steps from near zero (black) to near 100% (white). A linear chart is strange to look at. To the eye the steps at the black end seem much too big and at the white end, too small. The logarithmic grey scale chart has reflectance steps that differ from one another by the *ratio* of 1.4/1. These steps look more "equal" to the eye's logarithmic response. The logarithmic grey scale chart goes from "black to white" in 10 increments that appear roughly equal to the eye.[1] It is a reasonable goal that a TV system be able to reproduce this chart so that one can see all ten steps on the monitor. Some closed-circuit TV systems can do this; many slow-scan systems cannot.

There are several problems. First of all, the CRT is non-linear. The primary nonlinearity is in the electron gun itself. A one volt increase in voltage near cutoff causes much less beam current increase than a 1 volt increase near zero bias. I'll try to avoid the math; enough to say that the curvature is just the opposite of a logarithmic curve. The second part of the problem is that many slow-scan pickup devices are linear. What a strange thing to say! We want the complete transmission/reception *system* to be linear. The CRT has an inherent non-linearity. It turns out that what we really want is a compensating non-linearity in the pickup device. We want it to be logarithmic rather than linear, so that its curve, multipled by the CRT curve will give a reasonably straight line. Too many non-linearities to grasp? Perhaps fig. 2 will help. It shows what happens to the grey scale in various systems.

Flying-spot scanners, 7290 vidicons, and

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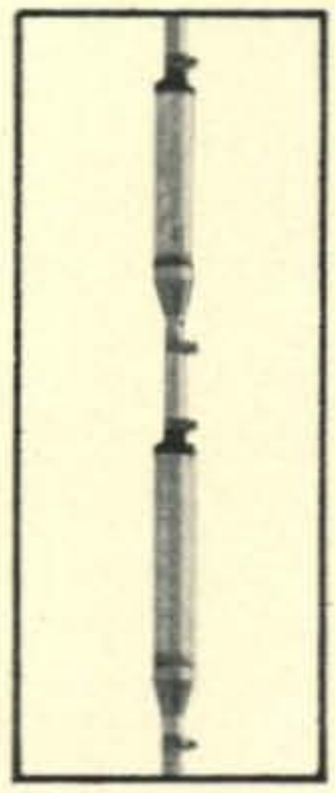

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Plumbicons are inherently linear devices. Conventional vidicons are logarithmic and therefore a sampling camera is logarithmic. The linear pickup devices give a picture that is very "contrasty." Things go from black to white in a hurry without many grey shades in between. Fortunately, in SSTV we are often looking at one specific object rather than a "scene." It is possible in these instances to carefully adjust the illumination to our pickup device to "center" what grey scale capability we have on the one object. OK for a start, but far from optimum. A better approach is feeding the linear pickup device into a logarithmic amplifier as shown in fig. 2.

Since the CRT non-linearity occurs in the monitor, why not correct it there? If it wasn't for noise entering the system in the transmission path, it wouldn't matter where the non-linearity is corrected. Look at fig. 2 again. If noise is mixed with the received signal it will ride in equal amounts on all the grey levels. If the grey steps are equal amplitude at this point in the system (as they will be with a logarithmic pickup device, or linear device with log amplifier) the noise will bother each grey step equally. If the steps are logarithmic, the noise will affect the black end much more than the white end. The darker grey shades get literally "lost in the noise."

The preceding was a discussion of the more or less classic TV system grey scale problem. In SSTV we have some unusual non-linearities that are added to the basic ones. The first wrinkle is that the afterglow brightness is not necessarily proportional to the "writing" brightness. This was touched on in the August column and will be discussed again in a moment. Other non-linearities may be present in the f.m. modulator or discriminator. Film non-linearities affect the flying spot scanner performance. My very first flying-spot-scanner used black and white negatives, and I found by accident that underexposed negatives gave much better system grey scale performance than normally exposed ones. We have much to learn about these non-linearities and how to use them to help, rather than hurt, system grey scale.

Summarizing, in testing our equipment we want to look at logarithmic grey scale charts with our cameras. Ideally we want to convert this logarithmic input to the camera into a linear step staircase signal for transmission, in order to optimize noise performance. A linear staircase signal is thus the appropriate test signal to feed into a monitor to visually check its grey scale capabilities.

Screen Brightness and Contrast

Closely related to the grey scale matter is the performance of long persistence phosphors. The P7 phosphor has been around since World War II, and while the RCA curves give persistence data under certain operating conditions, there is no overall industry control of phosphor characteristics. It is even possible for two manufacturers to take phosphor powder from the same batch and make tubes with different persistence characteristics due to differences in CRT processing techniques. We badly need more data in this area. What is the brightness at the instant of writing? Two seconds later? Eight seconds later? Actual measurements on production monitors and CRT's are needed. Special test equipment would have to be designed to get this data. I picture a photomultiplier tube married to a microscope that looks at a single scan line on the monitor. The problem is gathering enough light to get a good signal-to-noise ratio at the photomultiplier output.

Sync and Sweep Performance

In addition to various geometric distortions which were discussed last month, there are a number of factors than can please or displease you about monitor sweep performance. What happens when you tune from a local station sync'd to the 60 Hz line to a DX station sync'd to 50 Hz? Do the sweep oscillators on the monitor need readjusting, or does the size just change? How accurately must the receiver be tuned for the monitor to lock-in properly? If tuning is critical, is a tuning indicator provided? How easy is it to use?

The question of directly triggered horizontal sweep vs. the a.f.c. type is important. With a directly triggered sweep, if a sync pulse is not received, that particular scan never starts. If a single "false" sync pulse is received (QRM or noise at just the wrong frequency) a line will scan at the wrong time. In an a.f.c. sweep circuit the sweep oscillator runs continuously and its frequency and phase is controlled by comparing its retrace with the arrival of sync pulses, and generating a voltage that controls the oscillator's frequency. The advantage of this technique is more reliable performance under marginal conditions. An occasional missed sync pulse is not a disaster, an occasional extra one isn't either. This circuit is sometimes called a "flywheel" sync circuit. The comparison is apparent. The disadvantage of the a.f.c. circuit is that it normally takes an appreciable time to lock-in following a prolonged disturbance such

[*Continued on page 88*]

CQ Reviews: The Swan FM1210-A 2 Meter FM Transceiver

By Glen E. Zook* K9STH

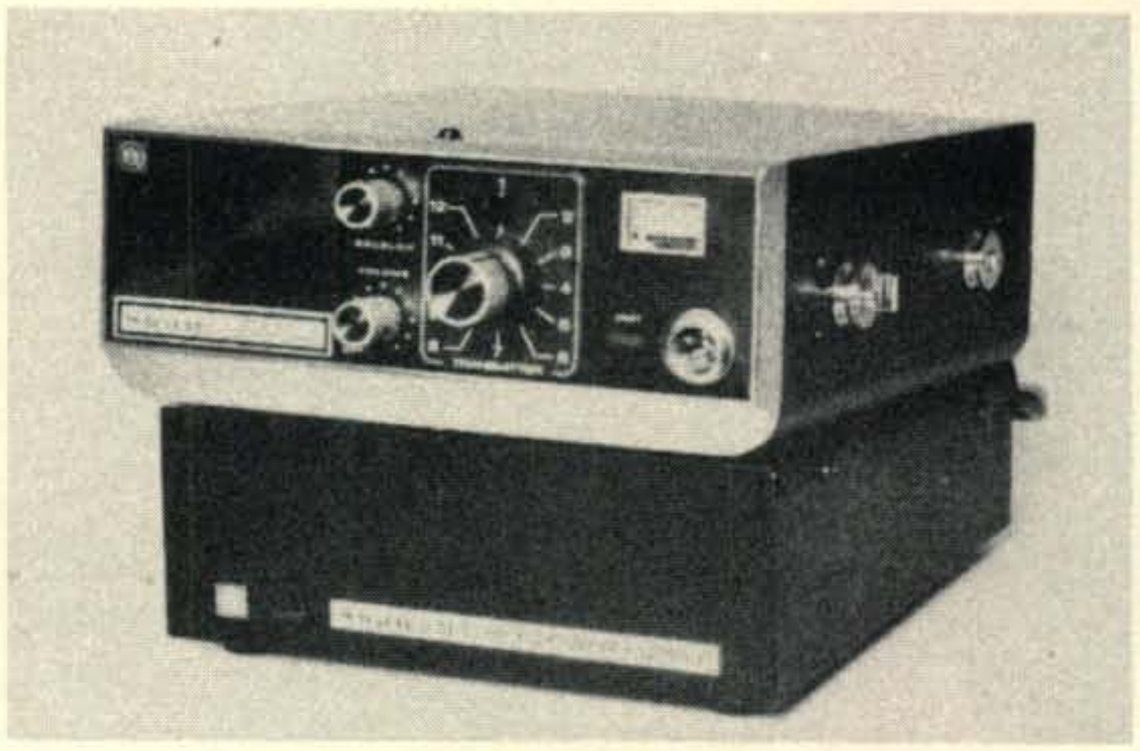
Swan Electronics' latest contribution to the amateur 2 meter f.m. world is the FM1210-A, a 12 channel, solid-state, f.m. transceiver in the 10 watt output class. Although the unit resembles the older FM-2X model, it is completely different. The receiver and transmitter frequency selector switches are separate from each other, thus giving a total of 144 different frequency combinations. Of these channels, four each transmit and receive slots are filled. Also included with the unit is a separate 12 v.d.c. output a.c. supply, microphone, antenna connector, mobile mounting bracket, spare fuses and pilot lamps. Front panel controls include frequency selectors, microphone jack, squelch control, on-off-volume control, receiver/transmit meter, and transmit indicator lamp.

Technical Details

As stated previously, the FM1210-A outwardly resembles the FM-2X. However, the inner working of the unit are quite different. Of course the FM1210-A is fully solid-state, but many changes have been incorporated. Of prime interest is the placement of all receive and transmit crystals in an oven assembly to insure frequency stability. Also, receiver selectivity is greatly improved.

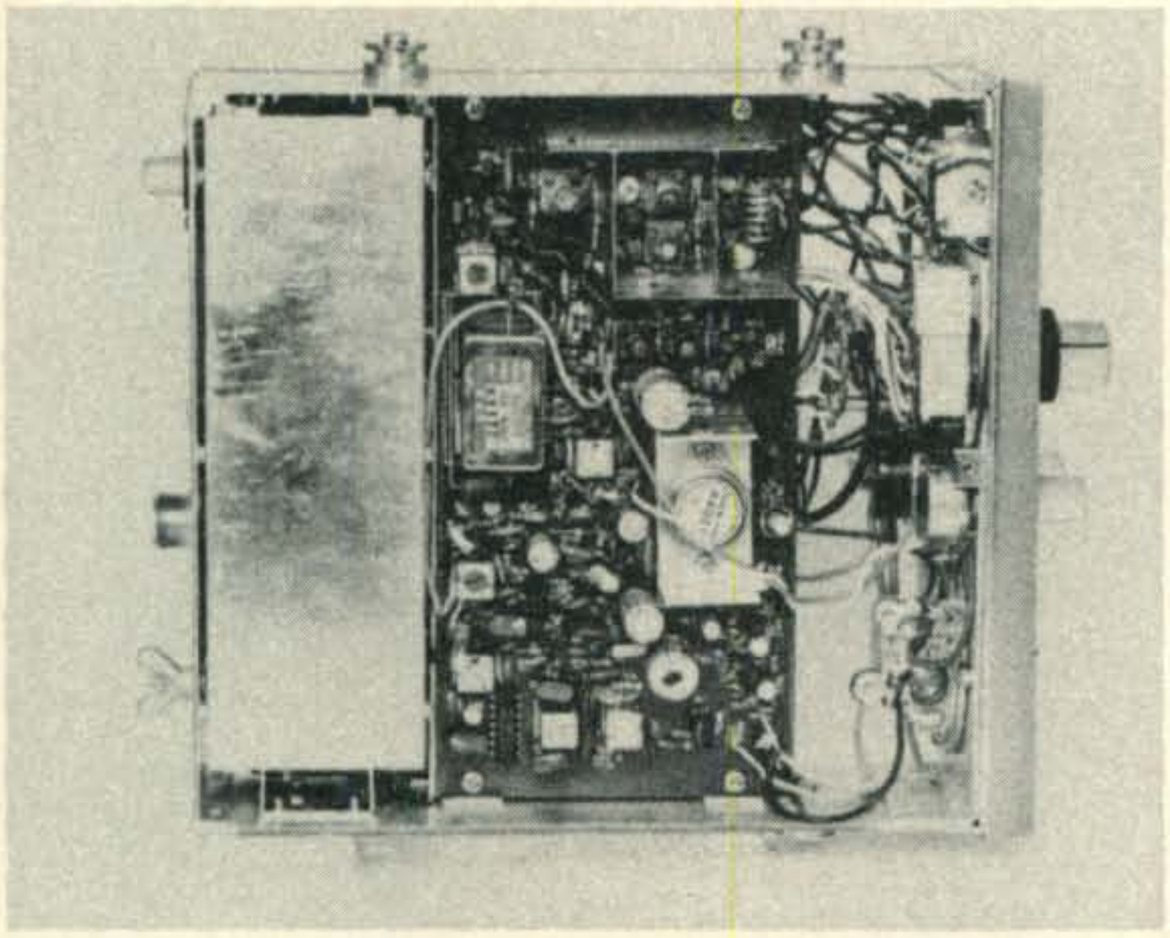
Transmitter: The transmitting section of the Swan is rather straight-forward. Crystal multiplication is 12 times, and modulation is provided by the phase method. Each crystal is selected by a 12 position rotary switch, and each is provided with an individual trimmer capacitor for warping to frequency. The output of the transistor oscillator is fed through a buffer stage consisting of a single transistor. The 12 mHz signal is then modulated by a single phase modulator stage with well-processed audio (including IDC). The 12 mHz energy is then amplified again in a single stage, then tripled in the next stage. The next two transmitting stages are doublers with five stages of amplification at 146 mHz. The final amplifier is protected from mis-matched loads by an "APC" or Automatic Protection Circuit. Basically this circuit samples the reflected power and applies a bias to the amplifier stage following the modulator. When the s.w.r. reaches a preset level, the transmitter shuts itself down until the problem is corrected. The sensitivity of this circuit can be set in the field if desired. Also, the final amplifier can be tuned while the unit is in the case through holes in the back apron. A low-pass filter and change-over realy complete the transmitter.

Receiver: The receiving section of the Swan FM1210-A is a bit unconventional in design. Although it is a dual-conversion superhet, the high i.f. frequency is 16.9 mHz rather than 10.7 mHz as in the FM-2X. A total of 12 channels may be selected by a rotary switch, giving a total of 144 transmit-receive combinations. The front-end of the unit consists of two JFET stages stagger-tuned to give uniform response over the entire 4 mHz of the two meter band. The first mixer is a bi-polar which mixes 130 mHz energy from the 1st oscillator/tripler chain. A buffer stage is provided between the tripler and mixer to provide isolation and rejection of unwanted harmonics. The resulting 16.9 mHz i.f. signal passes through a crystal filter and is amplified by a single bi-polar stage.



The Swan FM1210-A is a 12 channel transmit, 12 channel receive, 2-meter f.m. transceiver in the 10 watt output class. A.c. power supply is included as a separate package, but at no extra charge.

*FM Editor, *CQ*.



Topside of the Swan FM1210-A. Note the 16.9 mHz crystal filter and use of shielding in the front-end area.

Swan FM 1210-A 2M Transceiver

General Specifications:

Size: 8¼" × 7" × 3"; 8½ pounds

Power Requirements: 13.5 v.d.c. @ 0.3a. Stdby.; 2.5a. Transmit, 117 v.a.c. @ 8w. Stdby.; 30w. Transmit

Accessories Furnished: Microphone, a.c. power supply, mobile installation hardware, cables, and four each transmit and receive crystals.

Technical Specifications

Receiver	*Claimed*	*Achieved*
Sensitivity (20 db quieting)	0.5μv	0.27μv
Adjacent Channel Rejection		
±30 kHz	80db (+25 kHz)	83db
±60 kHz	none	86db
Audio Recovery (full quieting signal)		
±5 kHz dev.	1.5w.	1.7w.
±7.5 kHz dev.	1.5w.	1.8w.
±15 kHz dev.	1.5w.	1.9w.†
Number of Channels	12	12
Frequency Stability ...	0.001%	‡
Transmitter		
Power output		
a.c. supply	10 w.	12 w.
d.c. 13.5v.	10 w.	12.5 w.
Deviation		
Preset kHz	±6 max	±7
Maximum kHz	±7 max	±17
Number of channels	12	12
Frequency Stability ...	0.001%	0.0005%

† Noticable distortion at +15 kHz deviation

‡ Three of four receive crystals held 0.001%

The signal is then applied to the second mixer, also a bi-polar. 16.445 mHz energy is provided from the 2nd oscillator, and the resulting 455 kHz signal is amplified and limited by a single integrated circuit. Audio is removed from the signal by a discriminator, and amplified by two transistor stages and an integrated circuit output stage. Squelch is noise derrived.

Metering: A relative signal strength meter is provided on the front-panel. This meter also doubles as a relative power output meter.

Specifications & Performance

The Swan FM1210-A was operated in conjunction with the base power supply for several weeks with no problems. It was then run through its paces under controlled circumstances. The power output was in excess of the 10 watts rated, and receiver sensitivity was almost 6 db better than specs. Adjacent channel selectivity and spurious responses were also within specifications. The preset deviation was a hair above the factory specified settings, but not excessive. All frequencies except one receive frequency held within tolerances. This frequency was held after resetting the trimmer.

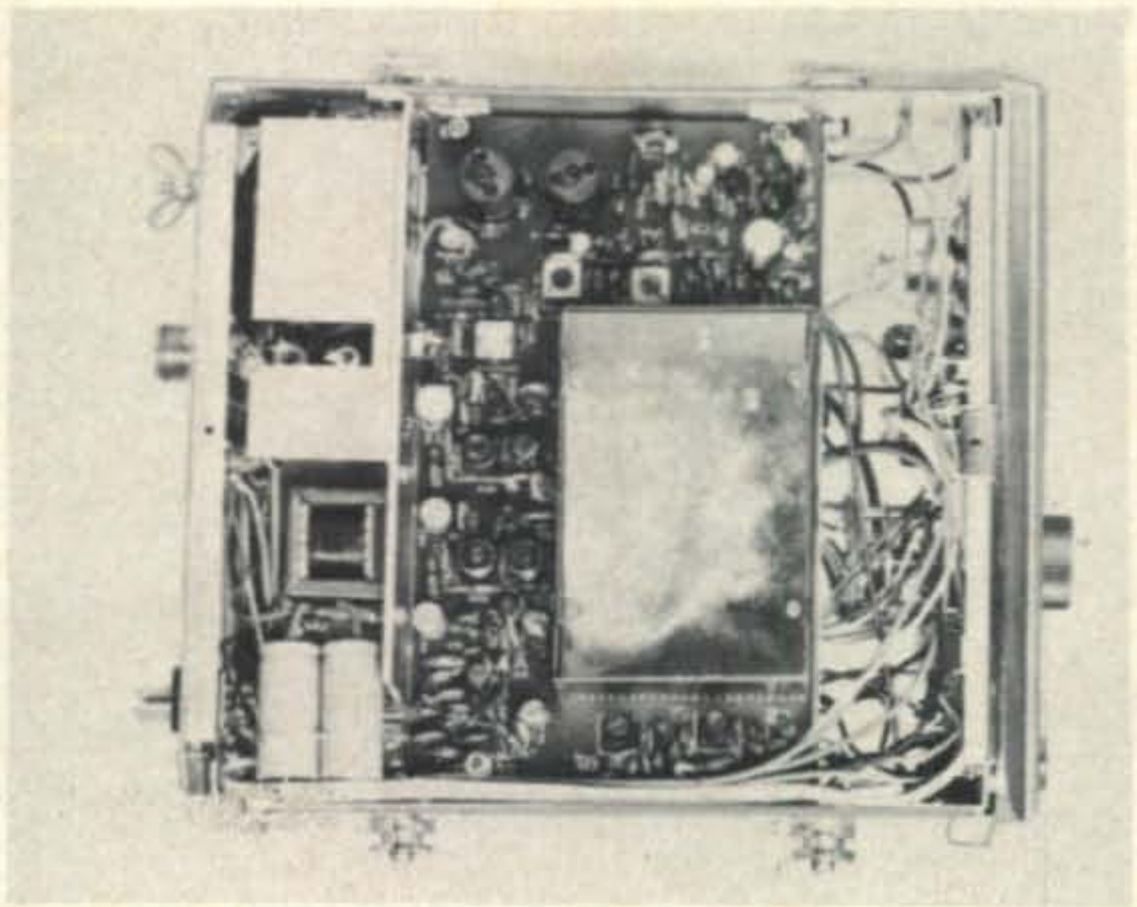
Transmit audio quality was excellent. Receiver audio was not quite as good due to the small size of the internal speaker (tinny sound). However, the received audio was still satisfactory.

Construction

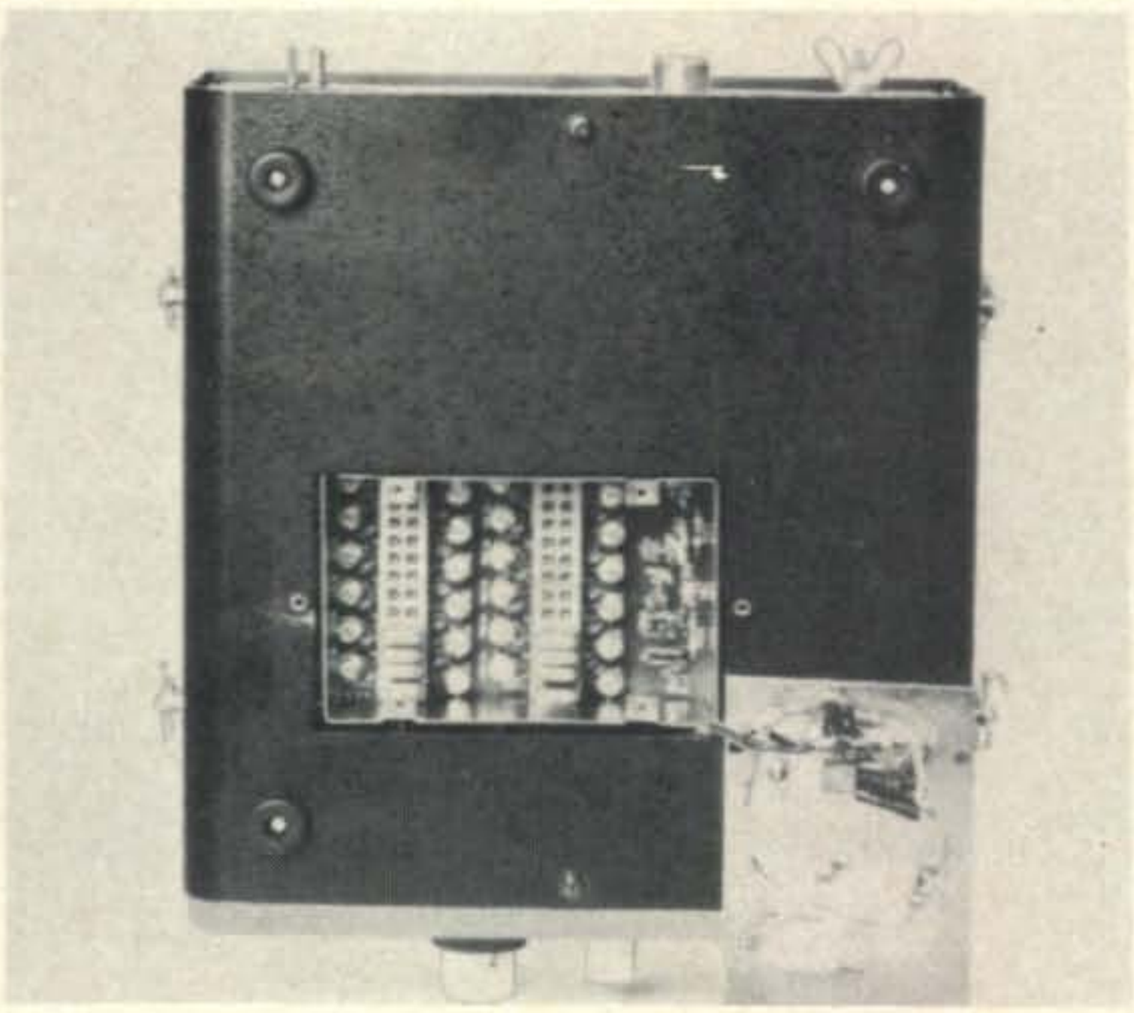
Construction of the Swan FM1210-A is quite good. A majority of the components are mounted on two phenolic circuit boards, including the crystal oven. The hand wired sections are acceptable, but improvement could be used in the area behind the front panel. The case and chassis of the unit and power supply are relatively rugged and should be able to take considerable abuse.

General Comments

As in all units some criticism is justified. First of all, the manual gets off to a good start with pictures of the circuit boards, schematic, and then leaves one cold with no alignment data except the "APC" level adjustments. Secondly, the transmit channel indicator is difficult to read due to it being a small mark on the knob aligning with an escutcheon on the front panel. Possibly, a small pointer on that knob might improve things. Also, the receiver indicator is difficult to read in direct sun light or high level indoor lighting. This is due to the indicator being back-lighted with a dark back-



Underside of the FM 1210-A. The large box at the center is the crystal oven containing both receive and transmit crystals for better frequency stability under widely varying environmental temperatures.



A hatch is provided for access to the crystals inside the oven. Note trimmer capacitors and the four crystals included.

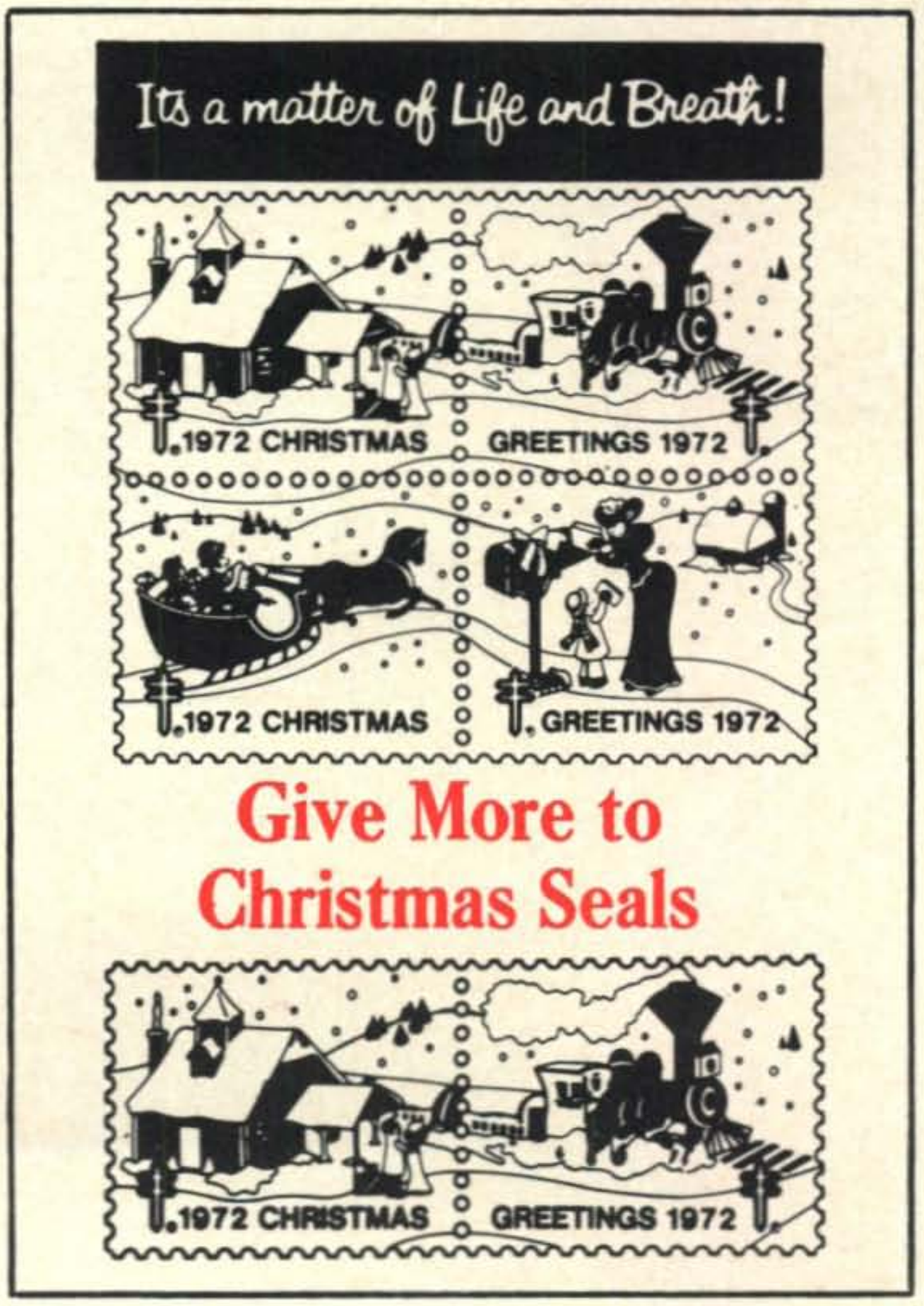
ground. Possibly changing to a dark numeral on a light background would help.

The selection of crystals included with the FM1210-A is a source of mixed-emotions. All four transmit and three of the four receive are excellent choices. The four transmit crystals are as follows: 146.220 mHz, 146.340 mHz, 146.760 mHz, and 146.940 mHz. Receive crystals are 146.280 mHz, 146.880 mHz, 146.760 mHz, and 146.940 mHz. It is the 146.280 mHz receive frequency that is a poor choice. 146.280 mHz is normally the input frequency for a 146.880 mHz output repeater. A much better choice would have been a 146.820 mHz crystal to go along with the 146.220 mHz transmit crystal. A check with Swan revealed that the person who made this decision was no longer with the company and the reason for the 146.280 mHz receive frequency decision was unknown. Possibly it was intended to be 146.820 mHz, but someone flip-flopped a number.

Now, back on the good side, the incorporation of an oven (using two lamps as heat source) is a good idea. Some amateurs using the solid state rigs, especially in regions with either high or low temperature extremes have degrees below zero F. In the South and Southwest temperatures in the summer often go over 100 degrees with a resulting 130 or 140 temperature inside a parked car. Then, when the air-conditioner is turned on, the temperature under the dash drops rapidly. Thus, an oven assembly eliminates quite expensive high accuracy crystals and still keeps the desired stability.

Next, the inclusion of an a.c. power supply in the basic package makes the unit a good deal for both base and mobile operation. Also, the number of crystals included is a bit unusual (and good!). Finally, the mobile mounting bracket is quite sturdy and should eliminate rattles that sometimes plague amateur f.m. installations.

All in all, if the budget can stand the $329.00 price tag, the Swan FM1210-A is worth considering. For additional information contact Swan Electronics at 305 Airport Road, Oceanside, California 92054. — *K95TH/5*



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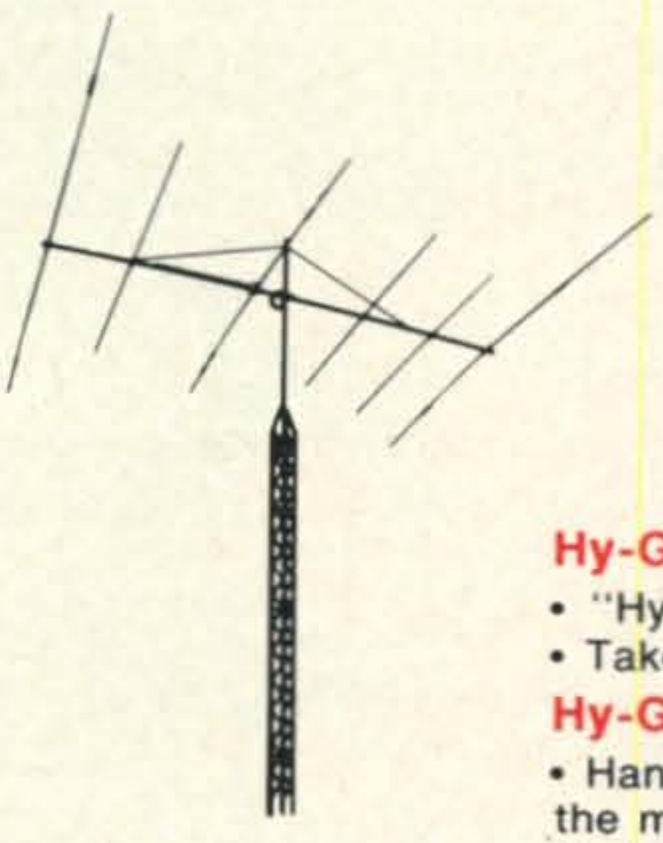

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MATH'S NOTES

BY IRWIN MATH,* WA2NDM

Since starting this column last April, we have received numerous requests for information regarding the various IC's and methods available for converting the common BCD outputs of most counting methods to either 7 segment, 10 line, or other codes, in order to operate various types of readouts. We have therefore decided to attempt to cover this topic fully for the next two months.

To begin with, let us first see just what BCD really is! Fig. 1 shows a very simple chain of four flip-flops connected as an elementary counter. Note that each flip-flop is shown as a block with certain inputs and outputs. For the sake of this discussion, these inputs and outputs will perform as follows:

T = Toggle input; a positive pulse to this point will change the state of the flip-flop.

R = Reset input; a positive pulse to this point will cause the flip-flop to come to what we will refer to as the "zero state" or "initial state" regardless of what state the circuit is in.

Q = Q output; this point will be of digital zero in the "zero state" and digital 1 in the triggered state.

$\overline{Q}$ = Q bar output; this point is the complement to the Q output. Whenever Q is zero, $\overline{Q}$ must be 1 and vice-versa.

Also, for our discussion, we will assume that a flip-flop will only be triggered (at the T input) by the fall time of a pulse and will ignore the rise-time (except when a reset pulse is applied).

As we can see from the first figure then, applying a positive pulse to the reset line will cause all flip-flops to go to the zero state and all outputs, which we have labelled A, B, C, and D, will become digital 0.

We will now apply a series of pulses to the input of the first flip-flop and see what happens. With the fall time of the first pulse, FF_1 will trigger and Q_1 will become high. With the fall time of the second pulse, FF will again trigger and Q^1 will now go back to zero. Since the input of FF^2 is connected to Q^1 however, it will see a fall time at this point, trigger, and cause Q^2 to become high. This action will repeat for all of the other flip-flops in the chain as shown in fig. 2. You will notice that all of the "action" occurs only at fall times.

Another way to show this sequence of events is in fig. 3. What we have done here is to simply list the 0 and 1 states in a column. This type of representation can be thought of as a binary code table since it seems to indicate the binary equivalent (1's and 0's) of the number of pulses fed into the counting chain. If we now introduce external circuitry into our flip-flop counter, to electronically force our counter to reset itself to the zero state after the ninth input pulse (*i.e.* on the tenth) we have created a decimal counter. Fig. 4 shows a "brute force" method of accomplishing this. At the completion of the ninth pulse, **A** is high (1) making $\overline{Q}$ low ((0) and **D** is high making $\overline{Q}^4$ low. These inputs, along with

*5 Melville Lane, Great Neck, N.Y. 11023.

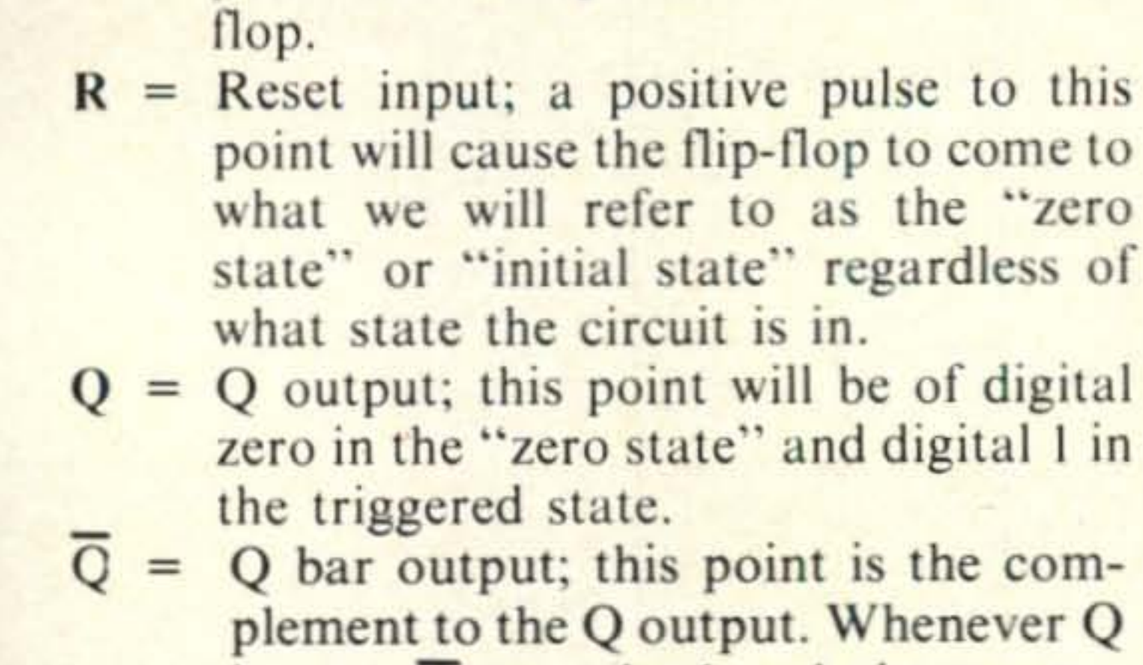

Fig. 1 — A simple flip-flop counter.

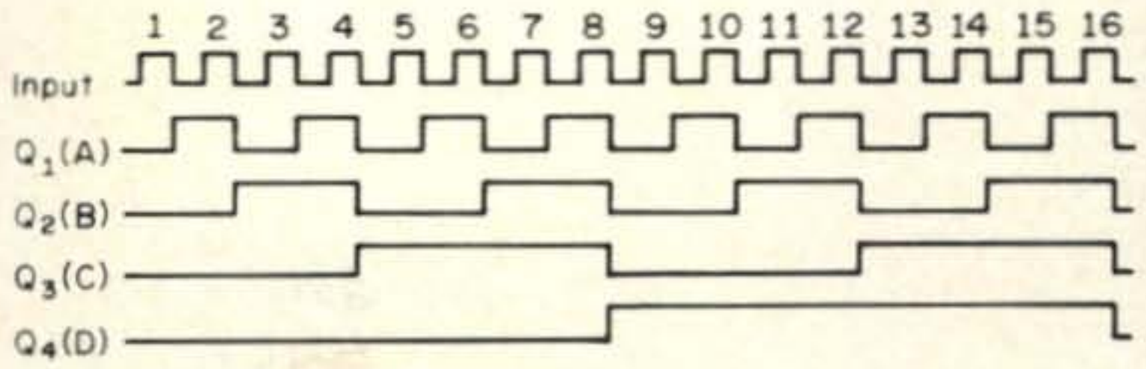

Fig. 2 — Various states for the flip-flops in fig. 1, when 16 pulses are applied.

D	C	B	A	After Input Pulse
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15
0	0	0	0	16

Fig. 3 — Zero and 1 states for fig. 2. Note that this representation is of the time after the application of the input pulses.

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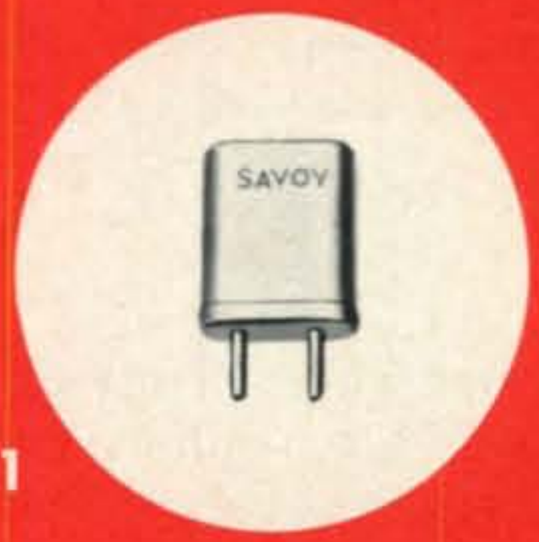

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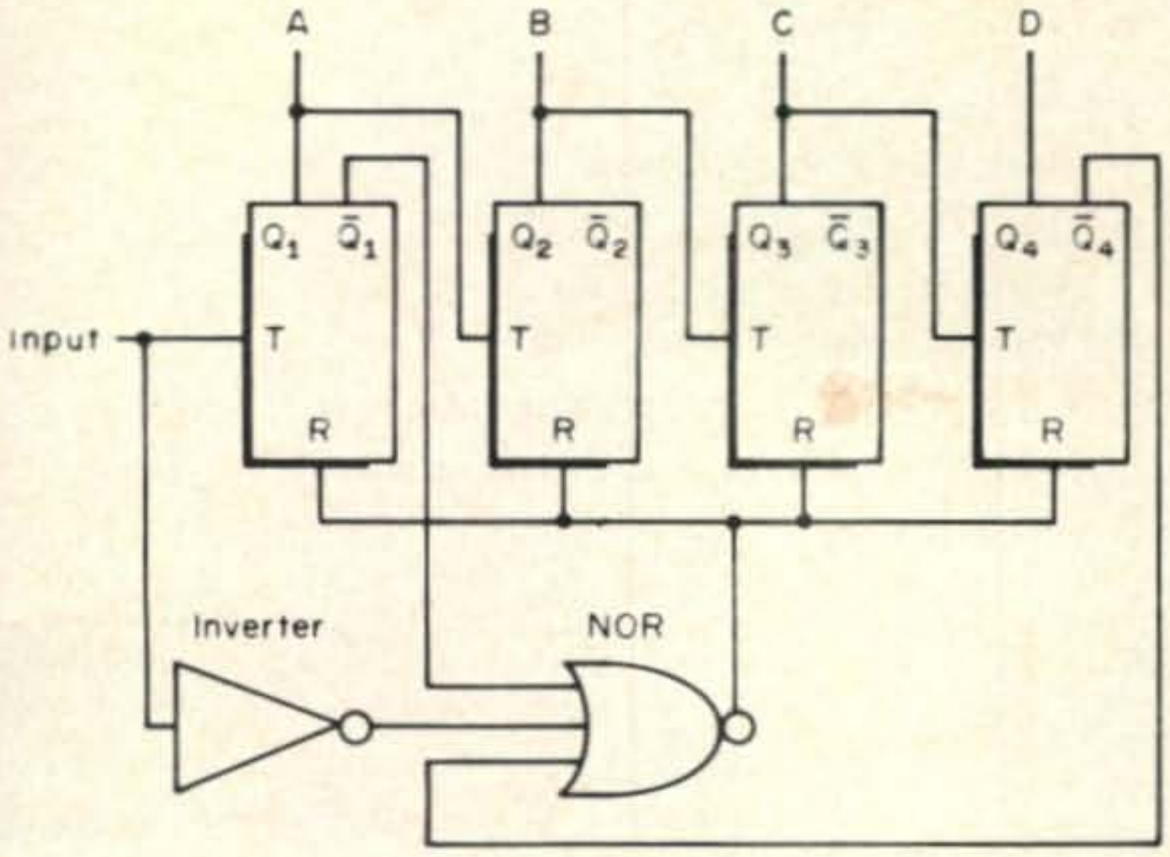

Fig. 4 — A "brute force" decimal or decade counter.

the inverted input is fed to a simple 3 input NOR gate. The characteristics of the NOR gate are such that when all 3 inputs are low, the output will be high.

When the tenth pulse comes along (remember — nothing will normally change in the flip-flops until the fall time) the third input will also become low due to the inverter and the NOR gate will produce a high output resetting all flip-flops to zero. As soon as this happens, $\overline{Q}^1$ and Q^4 becomes high and the reset line is disabled resulting in the entire counter chain winding up in the zero state. The chart for this counter is shown in fig. 5 and its information is known as BCD or binary coded decimal.

Some of the more common dividers or counter chips available with such a BCD output are: SN7490 decade counter; SN74196 50 mHz decade counter; SN74190 UP/DOWN decade counter; MC938 and MC780P decade counters (Motorola); 9306 UP/DOWN decade counter (Fairchild); 9310 and CuL9958 decade counters (Fairchild); and CD4017 decade counter (RCA). These chips are by no means the only ones available but represent typical surplus items at reasonable prices.

So, we now have a BCD output from our digital clock, voltmeter, frequency meter, etc. — how do we display it? The "old-fashioned" but least expensive way is to use a series of low cost lamps labelled "1-2-4-8" and connect them through suitable driver transistors to outputs A, B, C, and D as shown in fig. 6. Any high signal on an input line will bias the corresponding transistor full on, and will light the proper lamp. The problem with this method however, is that a calculation is required every time a reading is taken (the number 7 would light the 1, 2, and 4 lamps, for example). A much better method is to employ a BCD to decimal decoder circuit which will convert the 1-2-4-8 four line information to ten line information, a line

Fig. 5 — A BCD Chart of the circuit in fig. 4, and standard BCD output.

D	C	B	A	After Input Pulse
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
0	0	0	0	10

for each of the digits from 0 through 9. Such circuits can be built with gates as shown in fig. 7.

In the example each gate is a 4 input NAND gate. By remembering that all inputs to a gate must be high in order to have a low out-put, we can see that all outputs will be high except for the proper decoded output. To employ this circuit with our lamps, we must invert the output and employ ten lamps. Fig. 8 shows how to do this with a single PNP transistor for each lamp.

The ten lamp display just described is quite easy to read since only one lamp lights for each digit. It is not as "classy" as a composite readout however, but is the minimum that would be acceptable to most experimenters. Fortunately, you do not have to start interconnecting gates as complete BCD to decimal converters are available in integrated circuit form.

We will stop our discussion at this point as there are a couple of new items we would like to mention this month. In January we will resume with a list and description of the more popular types of BCD to decimal as well as 7 segment decoders. We will also cover storage chips and explain their function.

Fairchild Semiconductor has released its 3814, as MOS type device that combines all of the functions of a 4½ digit digital voltmeter in

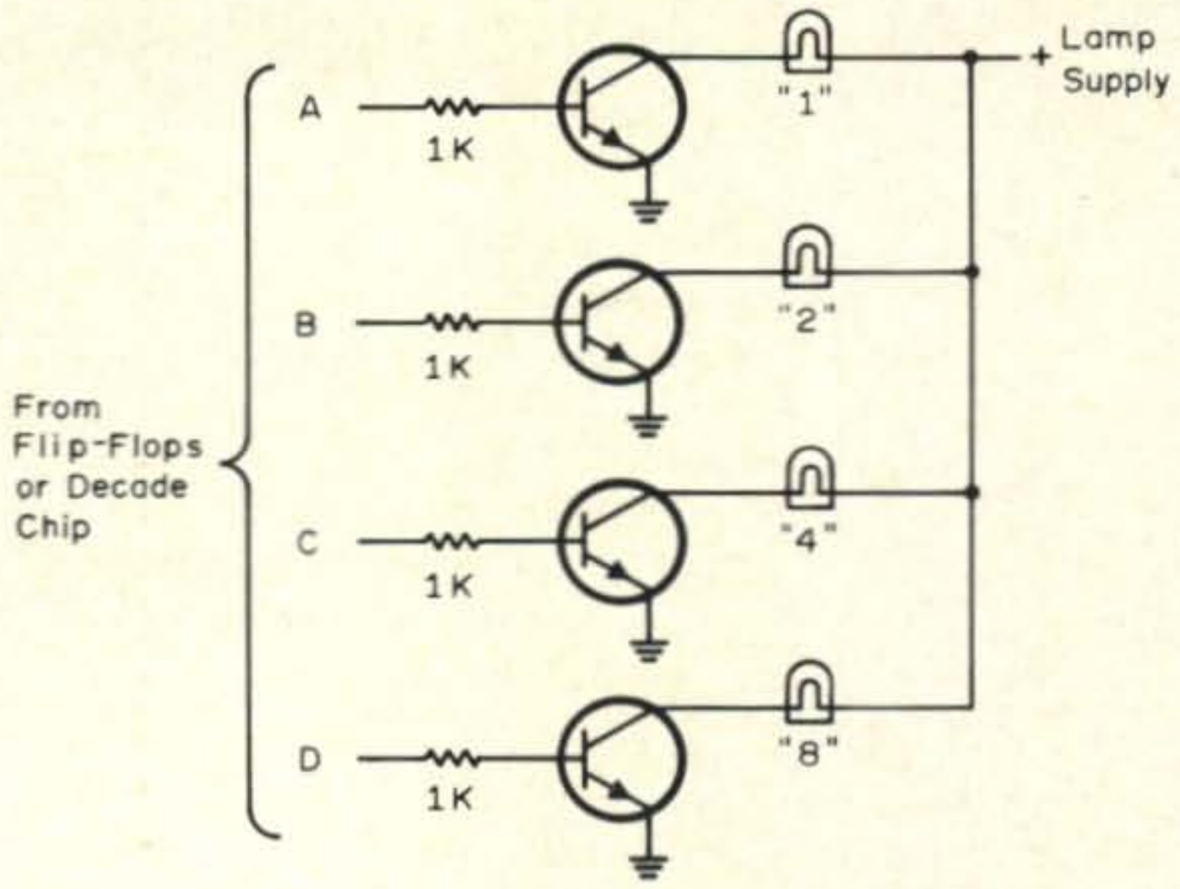

Fig. 6 — A simple lamp readout scheme. Alternately, voltage and current compatible lamps can be connected directly to flip-flops.

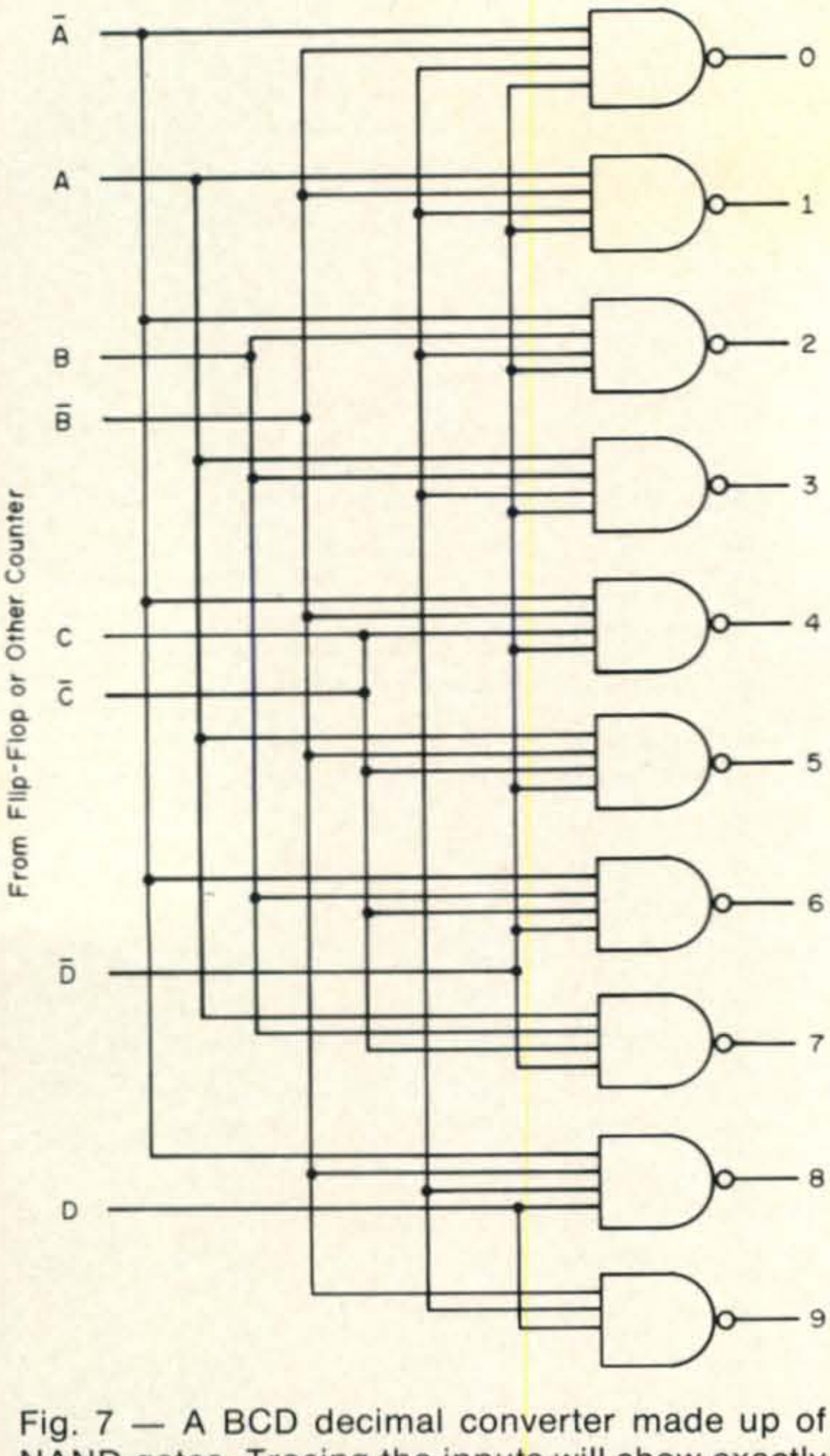

Fig. 7 — A BCD decimal converter made up of NAND gates. Tracing the inputs will show exactly how the decoder operates.

one single chip. In fact, with a 3814, all that is necessary is a decoder/driver (for BCD naturally) and readout of your choice. The entire chip is TTL compatible which will enable it to be used with the 7400 series. Cost is $16.25 in 100 quantity and probably in the $20 range for smaller quantities. I would suggest that interested people write directly to Fairchild at 313

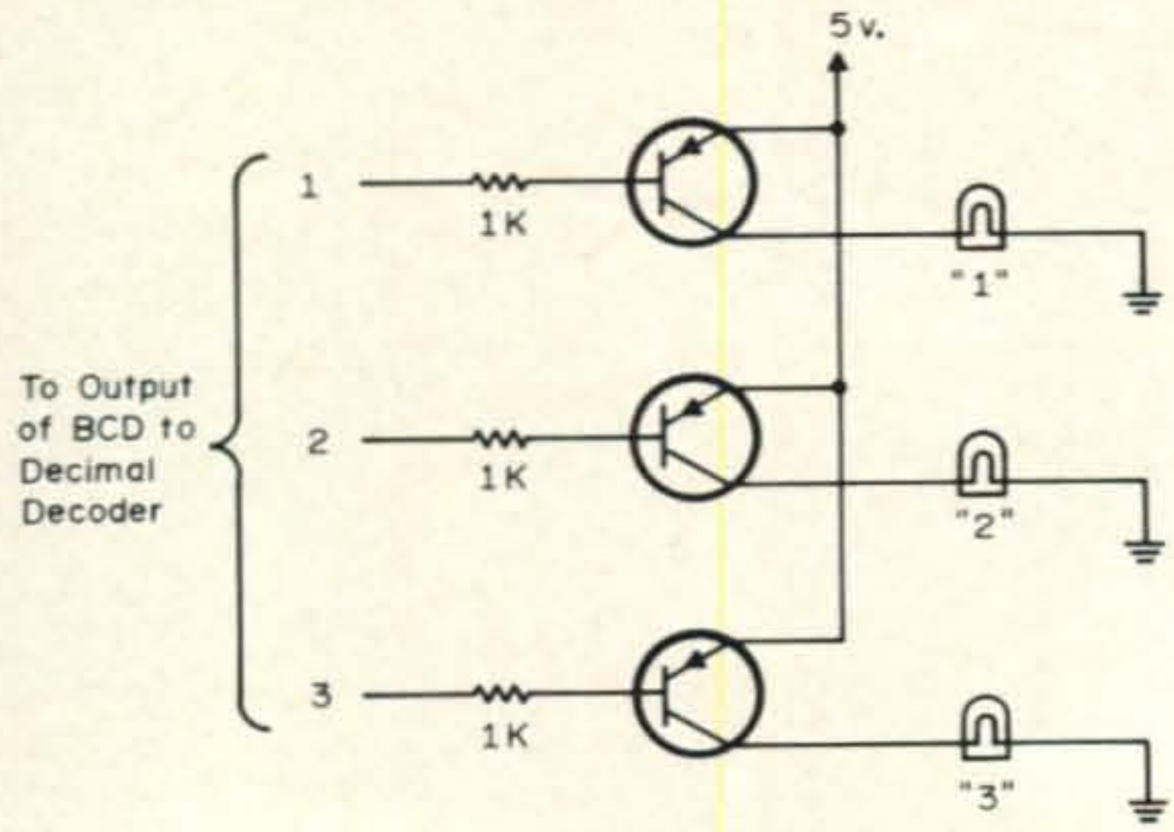

Fig. 8 — A driver circuit for use with 10 discreet lamps.

Fairchild Drive, Mountain View, California 94040 for a data sheet and price information, which should be available at the time you read this.

Another new item from Fairchild is their uA706 audio amplifier. This integrated circuit contains a 5 watt power amplifier and preamplifier with a 3 megohm input resistance and 4 ohm output. Enough internal feedback is provided to keep distortion at .3% for 50 mw output, .5% at 2 watts output and 3% at 4.5 watts. The entire unit is further designed to operate from a 12 volt supply and should be ideal for mobile receiver use. Cost is $2.50 per chip in 100 quantity and the chip should be available at this time. Again, write to Fairchild for lower quantity prices and data.

We are pleased to announce the availability of a new diode "pack" for experimenters being offered by M. Weinschenker, Box 353, Irwin, Penna. 15642. For $6.50 per half-pound $10 per pound) Morry will send you a batch of diodes, zener and otherwise, that you can sort and use in various solid state projects. We obtained a sample package and got the following:

23 - 200 piv or greater 2 amp silicon rectifiers
6 - 400 piv or greater 1 amp epoxy silicon rectifiers
42 - 1 watt zener diodes assorted voltages (epoxy)
110 - 400mw zener diodes assorted voltages (glass)
8 - 400mw reference zener diodes (the expensive kind)
6 - 3 amp 100 piv glass rectifiers
3 - 5 watt epoxy zener diodes, assorted voltages

At this point, we stopped counting — try it yourself and see why!!! Of the ones we checked only 1 bad unit showed up. We have been told however, that a typical 1 pound mix will contain about 1400 pieces, (it seems like a million!) and 80% good. Zeners and rectifiers will be present in power levels of 400mw, 1 watt and 5 watt and many (about half of our assortment) are labelled. At less than 1 each, how can you go wrong?

After our August power supply column was published, we received a number of letters and cards essentially saying, "Hey, you forgot the XYZ chip from ABC manufacturer for only 50¢ or the ZYX chip from CBA for only $2 each, 3 for $5." I must regretfully state that if these same readers had only written to me in advance I would have been most happy to share

[*continued on page 88*]

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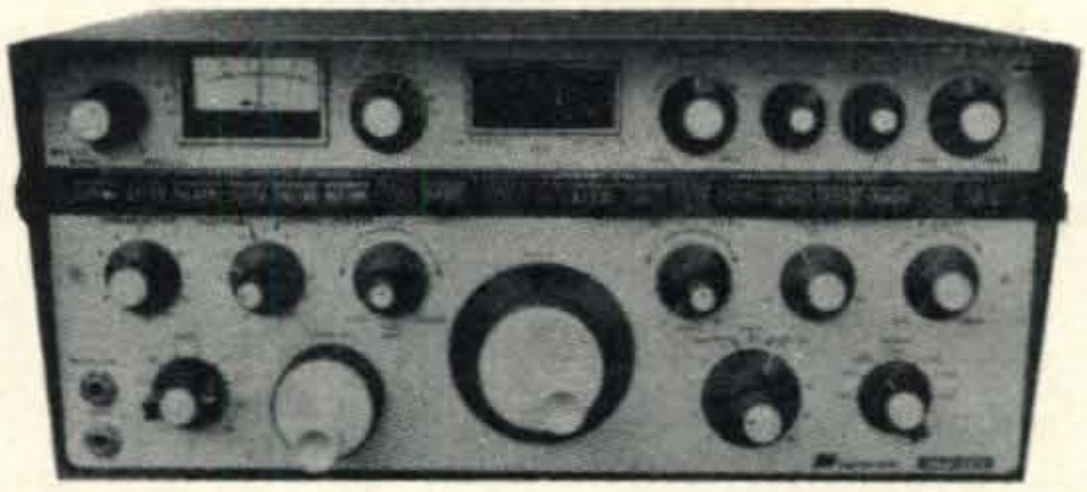

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- CARRIER and unwanted sideband suppression. Minimum 60db.
- IMAGE and IF REJECTION: more than 60db.
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- POWER AMPLIFIER: 8072 final completely broad-banded driver and final. 150 watts continuous dissipation rating.

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CT-1500	**State-of-the Art Transmitter** ..... Single VFO, 300 watts, PS-10 A/C required.	**$1450**
CR-1500	**Special Application Receiver** ..... Two VFO's.	**$1650**
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PS-10	**D/C Power Supply**	**$ 210**
EV-10	**VFO for CX-10**	**$ 225**
SC-10	**Station Console**	**$ 350**
CX-2X	**Two meter transverter**	**$ 460**

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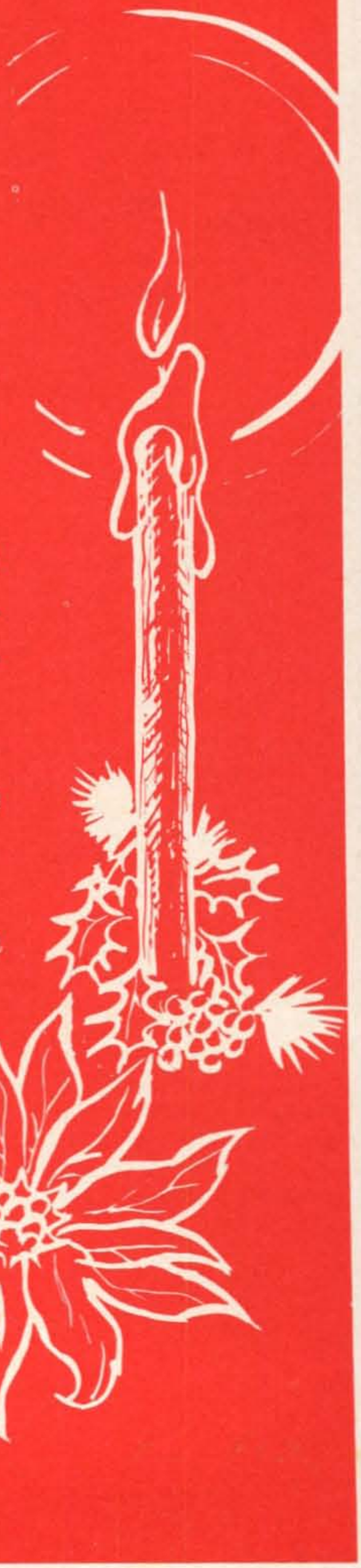


Announcing the Single Band Worked All Zones Award Program

BY JOHN A. ATTAWAY, K4IIF*

Effective Jan. 1, 1973, special WAZ awards will be issued to licensed amateur stations presenting proof of contact with the 40 zones of the world on one of the 5 high frequency bands, 80 - 10 meters. Contacts for a single band WAZ award must be made after 0000 hours GMT, Jan. 1, 1973. Proof of contact shall consist of proper QSL cards checked by the DX Editor or a member of the *CQ* DX Award's Advisory Committee. Single band certificates will be awarded for both two-way phone, including s.s.b. and a.m., and two-way c.w.

The first two-way c.w. winner and first two-way phone winner on *each* of the 5 bands will receive a handsome plaque showing that he is number one for that band and mode. Subsequent winners will receive numbered certificates.

Amateurs competing for the plaques must have their cards checked by the DX Editor, P.O. Box 205, Winter Haven, FL 33880. It is suggested that the cards be sent by registered mail as the winner will be determined by the earliest postmark.

The following overall rules apply to the single band WAZ program:

1. The official *CQ* WAZ Zone Map will be used in determining zone boundaries.
2. Confirmations must be accompanied by a list of claimed zones showing the call letters of the station QSOed and the mode. The list should also show the applicant's name, call letters, and complete mailing address clearly.
3. All contacts must be made with licensed, *land based,* amateur stations working in authorized amateur bands.
4. All contacts submitted by the applicant must be made within a 250 mile radius of the original location.
5. Any altered or forged confirmations will result in permanent disqualification of the applicant.
6. Continued use of poor operating ethics will result in disqualification of the applicant.
7. Include with the application $1.00 or 8 International Reply Coupons to defray the cost of the certificate.
8. Decisions of the *CQ* DX Awards Advisory Committee on any matter pertaining to the administration of this award shall be final. final.
9. All applications should be sent to the DX Editor, P.O. Box 205, Winter Haven, Florida 33880.
10. Zone Maps and/or WAZ applications are available from the DX Editor or from *CQ* for a self-addressed stamped envelope or self-addressed envelope and 1 IRC.

The following list of zones is presented as a guide. Any questions will be decided by the zone map.

Zone 1. Northwestern Zone of North America: KL7, VE8-Yukon, the VE8-Northwest Territories Districts of Makensie and Franklin, and the islands west of 102° including Victoria, Banks, Melville, and Prince Patrick.

Zone 2. Northwestern Zone of North America: VO2-Labrador, that portion of VE2-Quebec north of the 50th parallel, and a portion of the Northwest Territories-VE8 east of longitude 102°. The latter includes part of the District of Franklin and the islands of King William, Prince of Wales, Somerset, Gathurst, Devon, Ellesmere, Baffin, and the Melville and Boothia Peninsulas.

Zone 3. Western Zone of North America: VE7, W6 and the W7 states of Arizona, Idaho, Nevada, Oregon, Utah, and Washington.

Zone 4. Central Zone of North America: VE3, VE4, VE5, VE6, the W7 states of Montana and Wyoming, W0, W9, W8 (except W. Va.), W5, and the W4 states of Alabama, Tennessee, and Kentucky.

Zone 5. Easter Zone of North America: FP8, VE1, VO1, that portion of VE2-Quebec south of the 50th parallel, VP9, W1, W2, W3, the W4 states of Florida, Georgia, South Carolina, North Carolina, and Virginia, and the W8 state of West Virginia.

Zone 6. Southern Zone of North America: XE and XF.

Zone 7. Central American Zone: FO8-Clipperton, HP, HR, KS4, KZ5, TI, TI9, VP1, TG, YN, and YS.

Zone 8. West Indies Zone: CM/CO, FG7, FM7, HH, HI, KG4, KP4, VP2, VP5, VP7,

*DX Editor, CQ

KC4-Navassa, PJ2M/FS7, PJ2E, PJ2S, and YV0-Aves.

Zone 9. Northern Zone of South America: FY7, HK, PJ2, PZ, 8R, 9Y4, and YV.

Zone 10. Western Zone of South America: CP, HC, HC8, and OA.

Zone 11. Central Zone of South America: PY and ZP.

Zone 12. Southwest Zone of South America: CE.

Zone 13. Southeast Zone of South America: CX, LU, VP8, and Antarctic prefixes.

Zone 14. Western Zone of Europe: CT1, CT2, DJ/DL/DM, EA, EA6, EI, F, G/GB, GD, GI, GM, GW, HB, LA, LX, ON, OY, OZ, PA/PI, PX, SM/SL, ZB2, and 3A2.

Zone 15. Central European Zone: FC, HA, HV, I, IT, IS, OE, OH, OK, SP, UA2, UP, UQ, UR, YU, ZA, ZB1/9H1, 9A1.

Zone 16. Eastern Zone of Europe: UA1, UA3, UA4, UA6, UA9-Bashkir & Chkalov, UB5, UC2, UN1, and UO5.

Zone 17. Western Zone of Siberia: UA9-Sverdlovsk, Chelyabinsk, Komi, Jurgan, Molotav, Omsk, Tyumen, plus UH8, UI8, UL7, and UM8.

Zone 18. Central Siberian Zone: UA9-Novosibirsk, Tonsk, Kamerovo, and Altai; UA0-Keasnoyarsk, Irkutsk, Chita, Bruyate Mongolia, and Dickson Island.

Zone 19. Eastern Siberian Zone: UA0-Khabarovsk, Amur, Yakutsk, Primorsky, Sakhalin Island, Wrangle Island, and the Soviet Kuriles.

Zone 20. Balkan Zone: JY, LZ, OD5, SV, TA, YK, YO, ZC4/5B4, and 4X4.

Zone 21. Southwestern Zone of Asia: EP, HZ, MP4, 9K, VS9 (except Maldives and Socotra), YA, YI, 4W1, UD6, UF6, UG6, and AP-West Pakistan.

Zone 22. Southern Zone of Asia: AC3, AC5, CR8, 4S7, VU (except Andaman and Nicobar Islands), 9N1, and S. Bangladesh.

Zone 23. Central Zone of Asia: AC4, the BY provinces of Sinkiang, Kansu, and Hinghai, JT1, and UA0-Tanna Tuva.

Zone 24. Eastern Zone of Asia: BY (except the provinces in Zone 23), BV, CR9, and VS6.

Zone 25. Japanese Zone: HL/HM, JA/KA, and KR6.

Zone 26. Southeastern Zone of Asia: HS, XV, XW, XZ, 3W8, and VU2-Andaman and Nicobar Islands.

Zone 27. Philippine Zone: DU, KC6, and KG6.

Zone 28. Indonesian Zone: CR0, VR4, VK9 (except Nauru, Norfolk Is., and Christmas Is.), VS5, 8F, and 9M.

Zone 29. Western Zone of Australia: VK6, VK8, and VK9-Christmas Is.

Zone 30. Eastern Zone of Australia: VK1, VK2, VK3, VK4, VK5, VK7, and VK0-Macquarrie Is.

Zone 31. Central Pacific Zone: KB6, KH6, KJ6, KM6, KP6, KW6, KX6, VK-Nauru, VR1, VR3, and ZM7.

Zone 32. New Zealand Zone: FK8, FO8, (except Clipperton), FU8/YJ, KS6, VK9-Norfolk Is., VR2, VR5, VR6, ZK1, ZK2, ZL, and 5W1.

Zone 33. Northwestern Zone of Africa: CN2, CN8, CT3, EA8, EA9, 3V8, and 7X.

Zone 34. Northeastern Zone of Africa: ST, SU, and 5A.

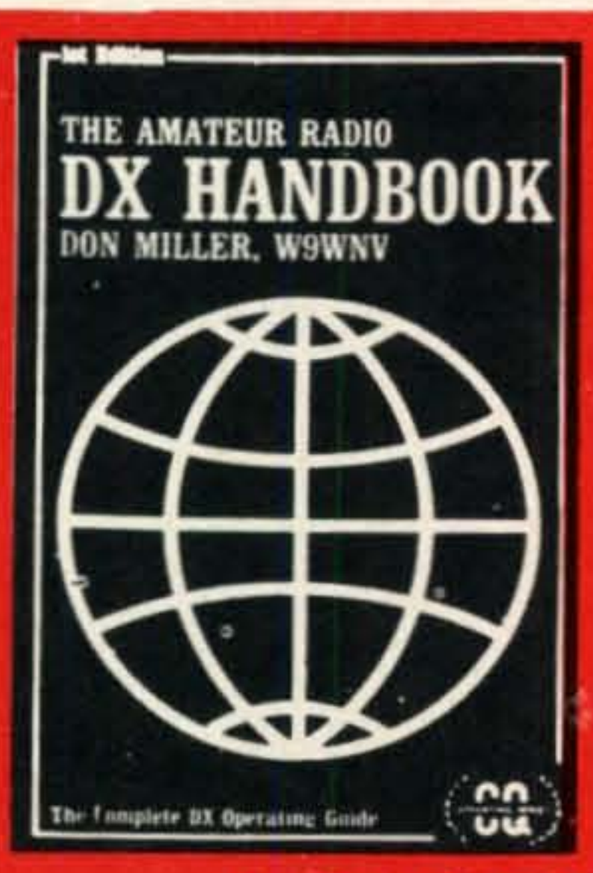
Zone 35. Central Zone of Africa: CR4, CR5-Guinea, EL, TU, TY, TZ, XT, ZD3, 5N2, 5U, 5V, 6W8, 9G1, and 9L1.

Zone 36. Equatorial Zone of Africa: CR5-Sao Thome, CR6, EA0, TJ, TL, TT, TN, TR, 9Q5, 9U5, 9J, ZD7, and ZD8.

Zone 37. Eastern Zone of Africa: CR7, ET2, ET3, FL8, 6O1, 6O2, 5H3, 5X5, 5Z4, and 7Q7.

Zone 38. South African Zone: ZD9, ZE, and ZS.

[*Continued on page 90*]



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DX

By Jerry Hagen, WA6GLD*

DX Hall Of Fame

The Northwest DX Meeting held on August 5 and 6 at the Double Tree Inn in Seattle was the setting for the induction of Ted Thorpe, ZL2AWJ and Chuck Swain, K7LMU into the *CQ* DX Hall of Fame. The presentation of the plaques was made by Rod Linkous, W7YBX (Western Washington DX Association *CQ* DX Committeeman) and accepted by Donald A. Miller, W9WNV/W6ERO.

Both Ted and Chuck were lost at sea during a tropical hurricane when returning from Wallis Island after operating as FW8ZZ in January of 1966.[1] Ted, ZL2AWJ was one of New Zealand's most active DXers and was also active in DX contests and from VR5AB and ZK2AF while Chuck had operated with Don on several DXpeditions including K7LMU/3W8, W9WNV/XU, W9WNV/8F3 and K7LMU/HS. As fate dictated. Don had returned to California to speak at the California DX Conference and did not accompany Chuck and Ted on the disastrous trip to Wallis Island as originally planned. As the foremost qualification for entry into the *CQ* DX Hall of Fame is service to the DX fraternity, it is only fitting that these individuals, who lost their lives for DXing, be honored and inducted.

CQ DX Hall of Fame
Gus M. Browing, W4BPD
November 1, 1967
John M. Cummings, W2CTN
March 23, 1968
Stewart S. Perry, W1BB
August 16, 1968
Richard C. Spenceley, KV4AA
March 1, 1969
Danny Weil, VP2VB
September 15, 1969
H. Dale Strieter, W4DQS
May 23, 1970
Stuart Meyer, W2GHK
October 31, 1970
Martine Laine, OH2BH
January 22, 1972
Ted Thorpe, ZL2AWJ
August 6, 1972
Chuck Swain, K7LMU
August 6, 1972

DXCC Country List Changes

In the September 1972 DX column a comment on the country list by this editor stated that no changes had been made by the ARRL as of press time. Well, true to form — two changes to the DXCC Countries List were made effective October 1, 1972. These changes are the annulment of Maria Theresa and the deletion of Minerva Reefs from the active country list. The deletion of Minerva Reefs was made because the Kingdom of Tonga annexed Minerva and the reefs no longer meet the mileage criteria of 500 miles from land of the same administration to qualify as a separate country. No official announcement of the reason for deletion of Maria Theresa was made, however it is presumed that the existance of this reef could not be verified. At the same time it is anticipated that Mellish Reef (located approximately 500 miles East of Australia) will be added to the DXCC List after VK9JW's highly successful operation. The two deletions and one addition reduce the total number of current DXCC countries to 321. These actions were in accord with recommendations made by the

CQ DX Hall of Fame plaques for Ted Thorpe, ZL2AWJ and Chuck Swain, K7LMU are accepted by Don Miller, W9WNV. The Awards were presented by *CQ* DX Committeeman Rod Linkous, W7YBX, on the left at the 13th Northwest DX Convention in Seattle

* P.O. Box 1271 Covina, California 91722

[1] "The DXpedition" *CQ* Mar., Apr., & May 1968.

Bill, W5SZV with his DX license plate in Texas. While at KC6WS Bill made over 9,000 QSO's and earned WPX and the CQ DX Award on 2XSSB.

ARRL DX Advisory Committee. The *CQ* DX column is pleased to see that these changes were the result of the DX Advisory Committee work as we feel that the DXers should play an important role in the administration of the competition as they contribute much effort and enthusiasm.

Special Interest DX Activity

The *CQ* DX column has always encouraged special interests within DXing as we feel that enthusiasm for 160 meters, 10 meters, QRP and mobile DXing are good for DXing and amatuer radio. An excellent opinion representing mobile DXers was written by W8KOI and is reprinted below:

I am very much interested in the *CQ* DX Awards program. However, there is a rule which seems unreasonable and a provision lacking for a special class of operators.

The rule requiring contacts be made from the same call area appears generous. The cover of any recent callbook will reveal that a substantial number of hams move every year as do the rest of the US population. My job has taken me to the 9th district for the last two years where I made my DX contacts and received QSLs. These being less than 100 are worthless. It was no less different working these from Wisconsin than it would be from Ohio.

Being an apartment dweller I am forced to do my h.f. operating 100% of the time as a mobile. I also enjoy my mobile DXing and I feel the 100 countries requirement is attainable. For the regular mobileer who travels in more than one call area and the amateur who puts in a rig just for vacation again have to throw out DX QSOs from any call area but their own. From Seattle to Tucson is a long way, but it is all the 7th call area. From Mobile, Alabama to Old Town, Maine is approximately the same distance but hams herein are at a disadvantage, quite unreasonably. I urge *CQ* to consider changing this rule for mobile operation.

The *Milliwatt*, a QRP group publication offers the special awards QRPP DXCC and QRPP Milliwatt for working over 100 countries with powers of under five and under one watt. The first QRPP DXCC award winner was

The other KC6 license plate in Texas is Bill's (KC6WS) XYL who was KC6YL and is now signing WA7SFA/5.

The CQ DX Award Program

C.W. DX

98	W2KXL	100	DL9PO
99	VE7BZC	101	W3FUM

S.S.B. DX

*219	K6GKU	230	TG9KE
229	EP2DX	231	YV1KZ
		232	DX5GX

* Omitted in error from previous listing.

CQ DX Award Endorsements

C.W.: DJ7CX-275, DJ7CX-28 mHz
S.S.B.: DL2VS-150, W9KRU, YV1KZ-300, W4WSF, EP2DX-Low Band

Complete rules for the *CQ* DX Award Program may be found on pg. 58 of the January, 1971 issue. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, CA 91722, or to the DX Editor.

awarded the trophy shown with lovely Karen Thomas. The *Millowatt* hopes that this will create more QRP interest.

In response to several requests of this nature, the *CQ* DX Committee is considering the addition of special endorsements to the *CQ* DX Award for Mobile and QRP DX accomplishments.

Outstanding DX Achievements

This months outstanding achievement is made to the Southern California DX Club for dillegence of members who have earned the 5 Band DXCC Award. As of this writing nine (9) members have qualified for the coveted plaque which is nearly 5% of the total number issued to date. Of course the start in 1969 was marked by much enthusiasm and many early morning phone calls! As 80 meter European signals are faint on the West Coast, heavy concentration on South America, Central America and the Carribean is a must. Activity from the Pacific and Asia is scant on 75%-80 meters so timely schedules were highly important. The first W6 award took 13 months to accomplish while several East Coast stations worked and received QSLs within 6 to 9 months. SCDXC recipiants of 5 Band DXCC are K6KA (14), W6NJU (5), W6ANN (26), W6JKR (43), WA6GLD (47), W6AM (54), W6EJJ (70), W6MAR (#126), and W6DQX (#180). It is interesting to note that all winners except W6ANN and W6AM used inverted "V" antennas. In addition to 5BDXCC, three members (W6NJU, W6JKR, and W6EJJ) have also been awarded 5BWAS. Congratulations to the Southern California DX Club for a fine DX achievement.

The Milliwatt recently awarded this trophy to Bob, K4OCE (CQ DX Committeeman for N. Carolina DX Association) for working QRPP DXCC. But who really looks at the trophy!!

The WAZ Program

S.S.B. WAZ

1023 .... JA3KWJ	1025 ..... ZS7P
1024 ..... W2GT	1026 ... OK1AWZ

C.W.-Phone WAZ

3410 .... W8RCM	3416 ..... DL9CC
3411 ... HA4KYH	3417 ..... DL9CC
3412 ..... 9Q5QR	3418 .. WA4WTG
3413 ... WA5RTG	3419 .... VE7BZC
3414 .....DJ7HF	3420 .....K6UFT
3415 ..... Dj0YD	3421 ..... I4CJW

Complete WAZ rules are shown on pgs. 64-66 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, FL 33880.

Frank, DL7FT operating from Albania as ZA2RPS in June of 1971. Frank is surprised at the large number of W/K Stations who have *not* requested QSL's. QSL direct to DL7FT.

WPX HONOR ROLL

The WPX Honor Roll is based on confirmed current prefixes which are submitted by separate application in strict conformance with the *CQ* Master Prefix List. Scores are based on the current Prefix total regardless of an operators all-time prefix count.

MIXED

W8LY	Michael Bakos	932
VE3GCO	Garry V. Hammond	925
W2NUT	Howard Gerberth	924
F9RM	Jean-Pierre Guillou	921
ON4QX	Bob Berge	886
PA0SNG	G. Mulder	882
W3PVZ	Joseph M. Olnick	882
W8ROC	Frederick W. Riecks	882
DL1CF	Heinz Hildebrand	872
K1SHN	Chuck Banta	867
DL1MD	Heribert Rechl	866
WA6MWG	John P. Billon	857
YU1AG	Djura Borosic	821
W9WHM	John R. Leary	811
G3DO	D.A.G. Edwards	810
DJ7CX	Leonhard Poelt	808
W4IC	George A. Mack	803
W4BQY	G. B. Fisher	802
W4CRW	Robert C. Sommer	798
W3GJY	John F. Wojtkiewicz	797
W0AUB	Bill Bergmann	785
I6SF	Serafino Franchi	780
W6ISQ	John G. Troster	758
W6TCQ	Bob Huntington	755
K8UDJ	Charles L. Hutchinson	750
CT1LN	Paulo J.S. Coelho Vieira	749
W4WSF	John C. Kanode	745
K0BLT	Frank Cahoy	733
PY4AP	"Biu" Marra	715
WB4KZG	Daniel K. Sullivan	710
K2ZRO	K. J. Deskur	708
WA5LOB	James Edwards	699
WA6EPQ	Larry Brockman	689
K2AAC	J. O. Archibald	686
K6SDR	Terry Baxter	686
W8GMK	John Marhefka	683
SM7TV	Boris Goransson	674
WA0CPX	Edward C. Gray	656

SSB

W4NJF	Gay E. Milius, Jr.	1001
CT1PK	Manoel F. De Almeida	930
DL9OH	Karl Muller	841
W9DWQ	Edward A. Goodbout	826
I0AMU	Alfonso Porretta	812
HP1JC	Juan G. Chen	800
I8KDB	Giampaolo Nucciotti	790
DL1MD	Heribert Rechl	774
W0YDB	W. C. "Bill" Higgins	760
PA0SNG	G. Mulder	758
K2POA	Arthur B. Johnson	733
G3DO	D. A. G. Edwards	719
I1ZV	Francesco Cherubini	716
F2MO	Michel Dort	711
W4IC	George A. Mack	702
K1SHN	Chuck Banta	697
W3DJZ	Arden B. Hopple	694
WA5LOB	James D. Edwards	692
ZL3NS	T. Ositis	685
W6RKP	James Chavarria	657
I4LCK	Armenghi Franco	608

CW

W8LY	Michael A. Bakos	928
W8KPL	William W. Simpson	853
W2HO	W. Vollkommer	825
W2AIW	Charles W. Rogers	813
DL1QT	Helmut Baumert	810
VK3AHQ	Henry Denver	809
ON4QX	Bob Berge	804
W9FD	W. W. Johler	740
WB2FMK	Robert J. Rasche	720
K1SHN	Chuck Banta	696
OK2DB	Jaroslav Dufka	693
G2GM	F. D. Cawley	687
DJ7CX	Leonhard Poelt	680
YU1AG	Djura Borosic	670
SM5BNX	Ake Sundvik	652
W4IC	George A. Mack	652
K2AAC	J. O. Archibald	650
I6SF	Serafino Franchi	639
W7ISQ	John G. Troster	638
K1LWI	F. Wendell Boyden, Jr.	629
W8GMK	John Marhefka	628
K2ZRO	K. J. Deskur	612
VO1AW	Clarence Mitchell	605
VE4OX	D. E. McVittie	600
OK2QX	Ing. Jiri Pecek	598

It is with great tribute, but also sadness that Joe Hiller, W4OPM, now a silent key, is being retired as the All Time Leader of the Mixed, CW, and SSB WPX Honor Rolls. Joe's enthusiasm, operating skill and sportsmanship provide a standard which will be difficult for WPXers to equal. His help with WPX News and service while a member of the *CQ* DX Committee will be greatly missed by the *CQ* DX Department.

Here And There in the World of DX

Bert, K4BZH/VP7 has QRT from Andros Island, Bahamas and relocated to Florida. He has received no QSL's since moving, and will be glad to QSL-address in QSL section — John, CT2AK works all bands and is the holder of WAS and DXCC and is pursuing WAZ, WPX and 5BDXCC — ZF1WE, is net control for the Cayman Turtle Net which consists of former ZF1 call holders. Bill (ZF1WE) is manager of the Pan-Cayman house where visiting hams most likely operate. The Posts and Telegraph Department is very cooperative in issuing reciprocal licenses. — The 37 foot ocean racing yacht *Tamure* is making a voyage through the French nuclear test area. The purpose was to protect atmospheric and marine pollution. Amateur ham operation will be conducted by ZL1BNA — Carl, KA2QW, president of the FEARL transferred in August. — The Camel Drivers Radio Club bulletin is edited by YA1AB and active YA's reported are YA1RA, YA1WC, YA1GNT, YA1KY, YA1LM, YA1FD, YA1AH, YA1GVM, YA1OS, and YA1NDF. The YA net meets on Fridays on 7040 kHz at 0330Z and Saturdays at 14285 kHz at 1500Z. The Gozo Amateur Radio Society has convinced the Malta licensing authorities to assign 9H4 calls to Malta amateurs located on Gozo Island — Great for WPX! — W3CK spent 61 days in XE land with a travel trailer, but without any amateur operation. Reciprocal licensing with Mexico has not been established — The KA1DX operation was from Marcus Island with WB6CGM, KA2AA, KA2AS, and KA2BL planning to make the DXpedition — Bryce, ZL3JC is attempting to get a WAS-Novice and needs assistance to work Novices in Vermont, New Hampshire, and Delaware. His address is: Bryce Thornton, 95 McKenzie Av., Christchurch, New Zealand — Ken, C21TL and custodian of C29ED states

[*Continued on page 92*]

I4ZSQ was recently awarded the SSB WPX Award and scored over 1 million points in the 1971 CQ WW Phone Test.

The WPX Program

S.S.B. WPX

710 ..... WB8IAY
711 ..... DX5GX
712 .... SM7DNL
713 .... HB9ARL

C.W. WPX

*1186 ... W2GRR
1196 ..... HA3GJ
1197 ... WA1JMP

Mixed WPX

349 .. WA4LDM
350 ..... K3NEZ
351 ..... VE7BZC
352 .... W6JHV/7
353 .... K8MMH

VPX

43 DL-12-936

* Omitted in error from previous listing

WPX Endorsements

S.S.B.: DK5GX, SM7DNL-250, W9KXK-500, W0GYM-650, W8GKM, CT1LN-700
C.W.: CT1LN-350, K2MFY-450, VE1MF-500, TU1SF-700
MIXED: K2MFY-500, WB4KZG-700, CT1LN-800, W3PVZ-900
WPNX: WN4SIJ-150
80 Meters: WA4LDM
10 Meters: W2EHB
160 Meters: WA4LDM
Europe: W3AIZ, WA1JMP, K3NEZ
North America: K2MFY
Oceania: W4WSF

Complete rules for WPX, WPNX and VPX may be found on pg. 67 of the February, 1972 issue. Application blanks and reprints of the rules may be obtained by sending a business size self-addressed stamped envelope to Award Manager, P.O. Box 1271, Covina, CA 19722 or to the DX Editor.

Propagation

BY GEORGE JACOBS, *W3ASK

The big story is still the sunspot cycle and its unexpected *rise* in activity.

According to daily observations made of the sun at the Zurich Observatory, a monthly mean sunspot number of 74 was reported for August, 1972. This results in a smoothed sunspot number of 72, centered on February, 1972. The solar cycle has *increased* by 7 points between August 1971 and February 1972, when it should have *decreased* by about 10 points.

Solar activity is now almost 50% higher than predicted earlier this year, with a smoothed sunspot number of 51 now forecast for December, 1972. A more detailed discussion of the present solar cycle will appear in next month's issue of *CQ*, entitled "Sunspot Cycle 20 — The Cycle That Wouldn't Quit."

The level of solar activity expected this month should result in good DX propagation conditions on the h.f. amateur bands.

For example, the 10 meter band should open an hour or so after sunrise, peaking on signals from an easterly direction before noon; from a southerly direction during the afternoon hours; and from a westerly direction during the late afternoon and early evening hours.

Excellent openings are expected on the 15 meter band, to one area of the world or another, from shortly after sunrise through the early evening hours. This should be the optimum band for DX openings during much of the daylight period.

Good-to-excellent DX propagation conditions are forecast for 20 meters during December. Opening at sunrise, the band is expected to remain open to one area of the world or another through the daylight hours and into the early evening. To some areas of the world, 20 meters may remain open during many of the hours of darkness as well. Optimum DX conditions are expected on this band during and shortly after local sunrise, and again during the late afternoon and early evening hours.

DX propagation conditions on the lower frequency amateur bands should improve during December and the winter months. This is the season when static levels should be at their lowest values in the northern hemisphere, and signal levels to many areas of the world should be stronger than at any other time of the year. The 40 meter band is expected to open for DX during the late afternoon hours, with the first signals coming from Europe and other areas in a northeasterly direction from the USA. During the hours of darkness DX should be possible to many areas of the world, and during and shortly after sunrise, DX conditions are expected to peak to Oceania and to other areas in a generally southerly and westerly direction.

Fairly good DX conditions are also expected on 80 meters during December. Openings with relatively strong signal levels should be possible to many areas of the world during the hours of darkness, with conditions expected to peak as the sun rises at the easternmost terminal of a DX path.

Even the 160 meter band is expected to have its share of DX during December. Some openings are likely to take place when the transmission path is entirely in darkness, or when part of the path is in darkness and the other in either twilight or dawn.

V.H.F. Ionospheric Openings

Two significant meteor showers are expected during the month, which may make possible some meteor-scatter type openings on 6, and perhaps on 2 meters as well. *Geminids*, classified as a major shower, should begin on December 12 and last for about three days. The shower's maximum intensity is expected to take place at approximately 4 p.m. EST on December 13, with a meteor rate of about 50 an hour. Later during the month the *Ursids* shower should take place. It is expected to last from December 21-22, peaking at about 9 a.m. EST on the 22nd. A meteor rate of approximately 15 per hour is expected during the *Ursids* shower.

A secondary seasonal peak in sporadic-E propaga-

*11307 Clara Street, Silver Spring, Md. 20902

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For December, 1972

	Rating & Forecast Quality		
Propagation Index	(4)	(3)	(1)
Date			
Above Normal: 4, 9-10, 15, 22, 26, 29, 31	A	A	C
Normal: 1-3, 5, 8, 11-12, 14, 16-17, 21, 23, 25, 27-28, 30	B	C	E
Below Normal: 6-7, 13, 18, 20, 24	C	D	E
Disturbed: 19	D	D	E

Where *expected signal quality is:*

A — Excellent opening, exceptionally strong, steady signals.

B — Good opening, moderately strong signals with little fading and noise

C — Fair opening, signals between moderately strong and weak, with some fading and noise.

D — Poor opening, signals weak with considerable fading and noise.

E — No opening expected.

How To Use This Forecast

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the particular opening for any day of the month. For example, all openings shown in the Charts with a *propagation index* of (3) will be excellent on Dec. 4, but only fair on Dec. 5, etc.

The most powerful signals under the sun!

Something special for opening night

The matchless Hy-Gain/Galaxy GT-550A Transceiver. Treasured by Ham operators throughout the world as a true precision instrument. Unrivaled for performance, operating flexibility and dependability in mobile or fixed operation.

This is equipment for the truly discriminating operator. Rugged, no-nonsense good looks. Hard-working, high performance guts. And the highest power output you can lay your hands on... 550 watts.

Better drop a few hints. For complete information on the Hy-Gain/Galaxy GT-550A Transceiver and matching accessories have the XYL write:

HY-GAIN ELECTRONICS CORPORATION

P. O. Box 5407-FL • Lincoln, Nebraska 68501

How To Use The DX Propagation Charts

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 call areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. An * indicates 80 Meter openings. Openings on 160 meters are likely to occur during those times when 80 meter openings are shown with a *propagation index* of (2), or higher.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this Propagation column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

4. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. Appropriate *standard* time is used, *not* GMT. To convert to GMT, *add* to the times shown in the appropriate Chart 8 hours in the PST Zone, 7 in the MST Zone, 6 in the CST Zone and 5 in the EST Zone. For example, 14 in Washington, D.C. is 19 GMT and 20 in Los Angeles is 04 GMT, etc.

5. The Charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10 db loss, it will lower by one level.

6. Propagation data contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

tion is expected during December (the major peak occurs during the summer months). This should result in a few fairly good short-skip type openings on the 6 meter band, between distances of about 800 and 1400 miles. Sporadic-E conditions usually peak during the early evening hours, but some openings may occur at other times as well.

Trans-equatorial scatter, or TE openings on 6 meters usually fall off a bit during December, but some openings may still be possible between the southern half of the USA and South America. TE openings take place during the evening hours, peaking between approximately 8 and 11 p.m. at the path mid-point.

Some auroral-type v.h.f. ionospheric openings are also likely to occur during December, especially during periods when ionospheric conditions on the h.f. bands are below normal or disturbed. Check the "Last Minute Forecast" at the beginning of this column for the days that are most likely to be in these categories during the month.

This month's column contains DX Propagation Charts valid through February 15, 1973. Short-Skip Propagation Charts for use during December appeared in last month's column.

The Editor of this column would like to take this opportunity to extend his warmest wishes to everyone, everywhere, for a Merry Christmas and a very Happy New Year.

73, George, W3ASK

December 15, 1972 — February 15, 1973

Time Zone: EST (24-Hour Time)

EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	08-09 (1) 09-10 (2) 10-12 (1)	07-08 (1) 08-09 (3) 09-11 (4) 11-12 (3) 12-12 (2) 13-14 (1)	05-06 (1) 06-07 (2) 07-09 (4) 09-11 (2) 11-13 (3) 13-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	14-16 (1) 16-17 (2) 17-19 (3) 19-00 (4) 00-03 (3) 03-04 (2) 04-05 (1) 17-19 (⅛)* 19-20 (2) 20-02 (3) 02-03 (2)* 03-04 (1)*
Northern Europe & European USSR	08-10 (1)	07-08 (1) 08-11 (2) 11-12 (1)	06-07 (1) 07-09 (3) 09-12 (2) 12-15 (1)	17-19 (1)* 19-20 (2) 20-02 (3) 02-03 (2)*
Eastern Mediterranean & Middle East	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-12 (1)	23-02 (1) 05-07 (1) 07-09 (2) 09-11 (1) 11-13 (2) 13-15 (3) 15-17 (2) 17-19 (1)	18-20 (1) 20-22 (2) 22-00 (1) 2-23 (1)*
Western & Central Africa	08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	01-03 (1) 06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (4) 17-18 (3) 18-19 (2) 19-21 (1)	18-22 (1) 22-02 (2) 02-03 (1) 00-02 (1)*
East Africa	10-13 (1)	07-10 (1) 10-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	07-13 (1) 13-15 (2) 15-18 (3) 18-20 (2) 20-21 (1)	18-00 (1)
South Africa	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-14 (1)	07-09 (1) 09-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	06-09 (1) 12-14 (1) 14-15 (2) 15-17 (3) 17-19 (2) 19-22 (1) 22-01 (2) 01-02 (1)	18-19 (1) 19-21 (2) 21-00 (1) 19-22 (1)*
Central & South Asia	08-10 (1) 17-19 (1)	08-10 (1) 17-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 18-22 (1)	06-08 (1) 20-22 (1)

Southeast Asia	08-10 (1) 18-20 (1)	08-11 (1) 17-20 (1)	06-07 (1) 07-09 (2) 09-12 (1) 19-22 (1)	06-08 (1) 20-22 (1)
Far East	17-19 (1)	16-17 (1) 17-19 (2) 19-20 (1)	05-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-22 (2) 22-00 (1)	05-08 (1) 05-07 (1)*
South Pacific & New Zealand	12-14 (1) 14-16 (2) 16-18 (1)	10-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-21 (1)	06-07 (2) 07-09 (3) 09-11 (2) 11-19 (1) 19-23 (2) 23-06 (1)	01-02 (1) 02-04 (2) 04-07 (3) 07-08 (2) 08-09 (1) 04-05 (1)* 05-07 (2)* 07-08 (1)*
Australasia	09-11 (1) 16-18 (1)	08-12 (1) 14-16 (1) 16-20 (2) 20-21 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-14 (1) 14-16 (2) 16-19 (1) 19-22 (2) 22-02 (1)	03-05 (1) 05-07 (2) 07-09 (1) 05-08 (1)*
Northern & Central South America	08-09 (1) 09-10 (2) 10-13 (3) 13-15 (2) 15-17 (1)	07-08 (1) 08-11 (3) 11-13 (2) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	02-06 (1) 06-07 (2) 07-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-22 (2) 22-00 (1) 00-02 (2)	17-18 (1) 18-19 (2) 19-21 (1) 21-04 (4) 04-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-02 (3)* 02-04 (2)* 04-06 (1)*
Brazil Argentina Chile & Uruguay	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (2) 18-19 (1)	13-14 (1) 14-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-02 (2) 02-06 (1) 06-08 (2) 08-10 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-03 (1)*
McMurdo Sound Antarctica	Nil	07-10 (1) 14-16 (1) 16-18 (2) 18-19 (1)	17-19 (1) 19-20 (2) 20-23 (3) 23-01 (2) 01-04 (1)	00-05 (1)

Time Zones: CST & MST (24-Hour Time)
Central USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (2) 12-14 (1)	05-07 (1) 07-09 (3) 09-11 (2) 11-13 (3) 13-15 (2) 15-17 (1) 21-00 (1)	15-17 (1) 17-18 (2) 18-23 (3) 23-02 (2) 02-03 (1) 17-20 (1)* 20-01 (2)* 01-02 (1)*
Northern & Central Europe & European USSR	08-10 (1)	07-08 (1) 08-10 (2) 10-12 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-12 (2) 12-14 (1) 23-01 (1)	17-19 (1) 19-22 (2) 22-01 (1) 19-00 (1)*
Eastern Mediter-ranean & Middle East	08-11 (1)	07-08 (1) 08-10 (2) 10-12 (1)	06-10 (1) 10-14 (2) 14-16 (1) 22-01 (1)	18-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
West & Central Africa	08-09 (1) 09-12 (2) 12-14 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-19 (2) 19-21 (1)	18-21 (1) 21-23 (2) 23-01 (1)
East Africa	10-13 (1)	07-11 (1) 11-15 (2) 15-17 (1)	06-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-20 (1)	19-23 (1)
South Africa	08-09 (1) 09-12 (2) 12-13 (1)	07-09 (1) 09-11 (2) 11-14 (3) 14-15 (2) 15-16 (1)	07-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-21 (1) 23-01 (1)	18-19 (1) 19-21 (2) 21-23 (1)
Central & South Asia	08-10 (1) 18-20 (1)	08-10 (1) 19-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 19-22 (1)	06-08 (1) 19-21 (1)
Southeast Asia	08-10 (1) 18-20 (1)	08-11 (1) 16-17 (1) 17-19 (2) 19-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 16-18 (1) 18-20 (2) 20-21 (1)	04-07 (1)
Far East	16-19 (1)	07-09 (1) 14-16 (1) 16-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 17-18 (2) 18-19 (3) 19-21 (2) 21-23 (1)	02-08 (1) 04-07 (1)*
South Pacific & New Zealand	13-14 (2) 14-15 (3) 15-16 (2) 16-18 (1)	10-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (3) 09-12 (2) 12-15 (1) 15-17 (2) 17-22 (3) 22-00 (2) 00-02 (1)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 03-07 (1)*
Australasia	09-11 (1) 14-15 (1) 15-17 (2) 17-18 (1)	08-14 (1) 14-15 (2) 15-17 (3) 17-19 (2) 19-21 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-15 (1) 15-17 (2) 17-21 (3) 21-22 (2) 22-00 (1)	02-04 (1) 04-07 (2) 07-09 (1) 03-06 (1)*

North & Central South America	08-09 (1) 09-10 (2) 10-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (2) 07-11 (3) 11-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-00 (1) 00-02 (2) 02-06 (1)	18-20 (1) 20-22 (2) 22-03 (3) 03-05 (2) 05-07 (1) 19-21 (1)* 21-01 (2)* 01-04 (1)*
Brazil Argentina Chile & Uruguay	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	07-08 (1) 08-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-08 (2) 08-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-21 (3) 21-02 (2) 02-06 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-04 (1)*
McMurdo Sound Antarctica	Nil	07-09 (1) 14-16 (1) 16-18 (2) 18-19 (1)	16-18 (1) 18-20 (2) 20-23 (3) 23-01 (2) 01-03 (1) 07-09 (1)	22-05 (1)

Time Zone: PST (24-Hour Time)
Western USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	08-10 (1)	07-08 (1) 08-10 (2) 10-11 (1)	05-06 (1) 06-09 (2) 09-11 (3) 11-13 (2) 13-15 (1) 00-03 (1)	18-20 (1) 20-23 (2) 23-01 (1) 19-23 (1)*
Central & Northern Europe & European USSR	07-09 (1)	07-10 (1)	06-07 (1) 07-10 (2) 10-13 (1) 10-13 (1)	17-00 (1) 19-23 (1)*
Eastern Mediter-ranean & Middle East	07-09 (1)	07-10 (1)	06-07 (1) 07-10 (2) 10-13 (1) 00-03 (1)	18-21 (1)
West & Central Africa	08-09 (1) 09-12 (2) 12-14 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-13 (4) 13-14 (3) 14-15 (2) 15-16 (1)	06-10 (1) 10-13 (2) 13-15 (3) 15-16 (4) 16-18 (2) 18-20 (1)	18-22 (1)
East Africa	09-12 (1)	08-12 (1) 12-14 (2) 14-15 (1)	08-13 (1) 13-17 (2) 17-19 (1)	18-20 (1)
South Africa	08-09 (1) 09-10 (2) 10-12 (1)	07-09 (1) 09-11 (2) 11-13 (3) 13-15 (2) 15-16 (1)	07-11 (1) 11-14 (2) 14-17 (3) 17-19 (2) 19-20 (1) 00-02 (1)	18-20 (1)
Central & South Asia	17-19 (1)	08-10 (1) 16-17 (1) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-20 (2) 20-21 (1)	05-07 (1) 18-20 (1)
Southeast Asia	15-16 (1) 16-17 (2) 17-18 (1)	09-11 (1) 15-16 (1) 16-18 (2) 18-20 (1)	07-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-18 (1) 18-20 (2) 20-21 (1)	03-08 (1)
Far East	15-16 (1) 16-17 (2) 17-18 (1)	14-15 (1) 15-16 (2) 16-17 (3) 17-18 (2) 18-19 (1)	08-10 (1) 13-14 (1) 14-15 (2) 15-18 (3) 18-20 (2) 20-21 (1)	00-01 (1) 01-03 (2) 03-06 (3) 06-08 (2) 08-10 (1) 02-08 (1)
South Pacific & New Zealand	11-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	08-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-20 (2) 20-21 (1)	06-07 (1) 07-10 (2) 10-15 (1) 15-16 (2) 16-18 (3) 18-21 (4) 21-22 (3) 22-00 (2) 00-02 (1)	22-00 (1) 00-03 (2) 03-06 (3) 06-07 (2) 07-08 (1) 00-03 (1) 03-06 (2) 06-07 (1)
Australasia	13-15 (1) 15-17 (2) 17-18 (1)	08-12 (1) 12-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-14 (1) 16-18 (1) 18-22 (2) 22-00 (1) 02-05 (1)	01-03 (1) 03-06 (2) 06-08 (1) 01-03 (1) 03-06 (2) 06-07 (1)
Northern & Central South America	08-09 (1) 09-10 (2) 10-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-07 (2) 07-09 (3) 09-13 (2) 13-15 (3) 15-18 (4) 18-20 (3) 20-22 (2) 22-06 (1)	18-20 (1 20-22 (2 22-03 (3 03-04 (2 04-05 (1 19-21 (1 21-01 (2 01-04 (1
Brazil Argentina Chile & Uruguay	09-11 (1) 11-12 (2) 12-14 (3 14-15 (2) 15-16 (1)	07-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	12-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-20 (3) 20-01 (2) 01-06 (1) 06-08 (2) 08-12 (1)	20-22 (1 22-01 (2 01-04 (1 22-02 (1
McMurdo Sound Antarctica	Nil	07-09 (1) 14-16 (1) 16-18 (2) 18-19 (1)	16-18 (1) 18-19 (2) 19-22 (3) 22-01 (2) 01-03 (1) 07-09 (1)	23-05 (1

PLEASE USE YOUR ZIP CODE NUMBER ON ALL CORRESPONDENCE

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Nov.	**25-26**	**CQ WW DX C.W. Contest**
Dec.	2-3	Indiana QSO Party
Dec.	2-3	Telco. Pioneers QSO Party
Dec.	2-4	Lone Star QSO Party
Dec.	8-10	ARRL 160 C.W. Contest
Dec.	9-10	Delaware QSO Party
Dec.	24	Hungarian Contest
Jan.	6-7	Firebird QSO Party
Jan.	20-21	Louisiana QSO Party
Jan.	20-21	Arkansas QSO Party
Jan.	**26-28**	**CQ WW DX 160 Contest**
Jan.	27-28	French C.W. Contest
Feb.	3-4	Space Net VHF Contest
Feb.	9-11	QCWA QSO Party
Feb.	24-25	French Phone Contest
Feb.	24-25	YL-OM Phone Contest
Mar.	10-11	YL-OM C.W. Contest
Mar.	**24-25**	**CQ WW WPX SSB Contest**
Apr.	21-22	Bermuda Phone Contest
May	5-6	Bermuda C.W. Contest

Indiana QSO Party

Three Periods: (GMT)
Saturday, December 2, 1800 to 2200
Sun., Dec. 3, 0100 to 0500 & 1900 to 2200

This year's party is a joint affair by WA9MXG and WA9BWY. The same station may be worked on different bands and modes, and Ind. stations may work in-state stations for QSO points.

Exchange: QSO no., RS(T) and QTH. County for Indiana, and states, provinces or countries for all others.

Scoring: One point per QSO. Ind. stations use states, VE provinces and countries worked for their multiplier. Out-of-state stations use Indiana counties (max. of 92).

Frequencies: CW — 3575, 7075, 14075, 21075, 28075. Phone — 3905, 7275, 14275, 21375, 28575, 50400. Try phone on even hours.

Awards: Certificates to the top scoring station in each state, province, country and Indiana county.

Mailing deadline Dec. 31st to: Michael Wetzel, WA9BWY, 5139 S. Dearborn Street, Indianapolis, Ind. 46227. Include s.a.s.e. for results.

Telephone Pioneers QSO Party

Starts: 1900 GMT, Saturday, December 2
Ends: 0500 GMT, Monday, December 4

This is the 8th annual party in which telephone pioneers ham radio operators will be able to contact other members in the United States and Canada. The same station may be worked on each band but only one mode per band.

Exchange: Signal report, contact number and chapter name and number.

Scoring: One point for each exchange with a Pioneer, and one point for each chapter worked.

Frequencies: Phone — 3965, 7275, 14295, 21365, 28675. And 50.1 to 50.25 and 144.275 to 145.500. CW — 3565, 7065, 14065, 21065.

Be sure to indicate your chapter name on your log and mail no later than January 5th to: Frank J. Wojcik, W2SNJ, Stanley S. Holmes Chapter #55, Telephone Pioneers of America, 100 Central Avenue, Kearney, N.J. 07032.

Lone Star QSO Party

Starts: 2000 GMT Saturday, December 2
Ends: 0200 GMT Monday, December 4

This is the initial party sponsored by the Austin ARC. The same station may be worked on each band and mode, and in-state contacts are permitted for QSO and multiplier credit.

Exchange: QSO no., RS(T) and QTH. County for Texans, state, province or country for others.

Scoring: One point per QSO, 2 points if its with a Novice, 3 points Novice to Novice. Texans multiply QSO points by sum of states, Texas counties, VE provinces and DX countries worked. Others use Texas counties for their multiplier. (max. of 254. Wow!)

Frequencies: Phone — 3900, 7265, 14275, 21350, 28600. CW — 3560, 7060, 14060, 21060, 28600 (yes, 28600). Also VHF and Novice bands. Check 160 on the hour from 0400, and 15 mtrs. on the hour and 10 mtrs. on the half hour during the day hours.

Awards: Certificates to the top scores in each Texas county, state, province and country. There are also certificates for the highest scoring novice, mobile, VHF and 160 entry (min. of 15 QSO's, except DX entries). And trophies for the highest Texas and out-of-state scores.

Dupe sheets required for Texan entries with over 200 contacts.

Mailing deadline January 15th to: Tom Morrison, P.O. Box 13442, Austin, Texas 78711.

ARRL 160 C.W. Contest

Starts: 2200 GMT Friday, December 8
Ends: 1600 GMT Sunday, December 10

This is the 3rd Top Band contest by the ARRL.

*14 Sherwood Road, Stamford, Conn. 06905

This is the attractive medal awarded to the winners in the "7th World Orchid Conference Contest, "sponsored by the Radio Club of Colombia last April. Gold for 1st place, Silver for 2nd place, to continental and world winners. The gold winners were, YN1FI, YV5TO, HI8LC, VE3RE, ON5MG, ZL3NS, HK3CHX, HK4BLT. The silver winners were, YV5DTH, YV5JQ, HPIRI, W3YHR, SP5CKM, HK5CBR, HK4CJB. The medal is shown actual size. An emerald is in the center of the orchid.

Contacts on c.w. only will be between stations in ARRL sections, and with DX (no DX to DX).

Exchange: RST, ARRL section or country.

Scoring: Contacts between stations in ARRL section, 2 points, QSOs with other areas, 5 points. The multiplier is determined by the number of ARRL sections plus DX countries worked (max. of 74 sections, see list in *QST*).

Awards: Certificates to ARRL section and DX country high scorers.

A copy of your log is not required. You are of course required to keep a valid log of all contacts made. To report use one of the ARRL summary sheets and an alphabetical list of stations worked. (Operating Aid 6) A s.a.s.e. to ARRL Hq. will get you the necessary forms.

The usual grounds for disqualification, plus excessive duplicate contacts and etc. prevail. You may also be requested to submit a copy of your log for verification.

All entries must be received no later than Jan. 10, 1973 at ARRL Hq., 225 Main Street, Newington, Conn. 06111.

Delaware QSO Party

Starts: 2300 GMT Saturday, December 9
Ends: 2300 GMT Sunday, December 10

This one is sponsored by the Delaware ARC. Stations may be worked on each band but only one mode per band.

Exchange: QSO no., RS(T) and QTH. County for Del.; state, province or country for others.

Scoring: One point per QSO for Del. stations, multiply total by number of states, VE provinces and DX countries worked. Outside stations score 5 points for each Del. QSO and multiply total by Del. counties worked. (Total of 3, New Castle, Kent and Sussex.)

Frequencies: CW — 3560, 7060, 14060, 21060, 28060. Phone — 3975, 7275, 14325, 21425, 28650. VHF — 50, 50.4, 144 mHz. Novice — 3710, 7170.

Awards: Appropriate awards will be made to all winning scores. In addition a W-DEL certificate will be sent to any station working all 3 Del. counties. Party logs will be accepted in lieu of QSL cards. (Include a s.a.s.e.)

Mailing deadline is January 1st and logs and applications go to: Charles J. McGonigal, WA3AVD, 18 Harvard R., Wilmington, Del. 19808.

Hungarian Contest

Starts: 0000 GMT Sunday, December 24
Ends: 2400 GMT Sunday, December 24

This is a world wide type contest with operation permitted on all bands, both phone and c.w. There are three categories, single operator, multi-operator and s.w.l.

Exchange: RS(T) and your ITU zone number.

Scoring: Contacts between stations on the same continent 1 point, on different continents 3 points. If it's with an HA/HG5 it's worth 4 points, and 5 points if it's an HA5.

The multiplier is determined by the number of different ITU Zones worked.

Final Score: Total QSO points multiplied by the sum of ITU zones worked.

Awards: The world leaders in each of the three categories will receive the Budapest Memorial Plaque. And certificates to the top scoring station in each country in each category.

A summary sheet with the scoring and all necessary data, and a signed declaration is requested.

Mailing deadline is January 15th to: BRAI Contest Committee, P.O. Box 2, Budapest 134, Hungary.

Friendly Firebird QSO Party

Starts: 1800 GMT Saturday, January 6
Ends: 1800 GMT Sunday, January 7

The Firebird ARC is composed of employees and retirees of the General Motor Corporation. A certificate with endorsements is awarded to members and non-members who contact members in 20 or more GMC units. The QSO party was organized to aid those interested in securing this award.

Exchange: Signal report, state or country, and name, plus a four digit number corresponding to the GMC operating unit for members (non-members omit the number).

Scoring: One point per QSO, multiplied by number of different GMC units worked. A station may be worked only once regardless of band.

Frequencies: 3985, 7285, 14285, 21385, 28780, 50520, 145.440 and bottom portion of each Novice band.

Awards: Certificate to each entry with 20 different GMC operating units worked, with endorsements for each additional 20 units. There is a Trophy for the highest scoring non-member.

Logs go to: Dick McClain, W9MDW, 1613 Cherry Hill Lane, Kokomo, Indiana 46901, to be received by February 15th.

CQ WW DX 160 C.W. Contest

Starts: 2200 GMT Friday, January 26
Ends: 1600 GMT Sunday, January 28

Rules are the same as last year and will be given in detail in next month's Column.

Note the correction in the ending time, this is for the benefit of West Coast stations.

Multi-operator entries will be acknowledged but the emphasis is on single operator operation and the *CQ* Plaque for the highest contest score is for single operator stations only.

This year particular attention will be given to state-side stations operating in the "DX Window" (1825-1830) which should be kept clear of W/K and VE operation, especially during DX hours.

And we hope the phone boys will also be cooperative for this week-end.

Log sheets and United States Regulations for 160 may be obtained from *CQ*. Include a large s.a.s.e. with sufficient postage with your request.

Editor's Notes

If you have not already sent in your Phone log, time has just about run out. The 1st of this month is the deadline. You have until the 15th of January for your C.W. entry. Remember all scores and calls will be listed in the final results, and check logs are sometimes very useful.

A reminder to you fellows on the move, APO QTH's and etc. Your permanent or state-side address is a must. Certificates will not be sent out until late next summer.

It was inevitable that we would be receiving some response to our action in the disqualifications in our last WW Contest. An overwhelming majority favored our action. A couple of anonymous letters were critical.

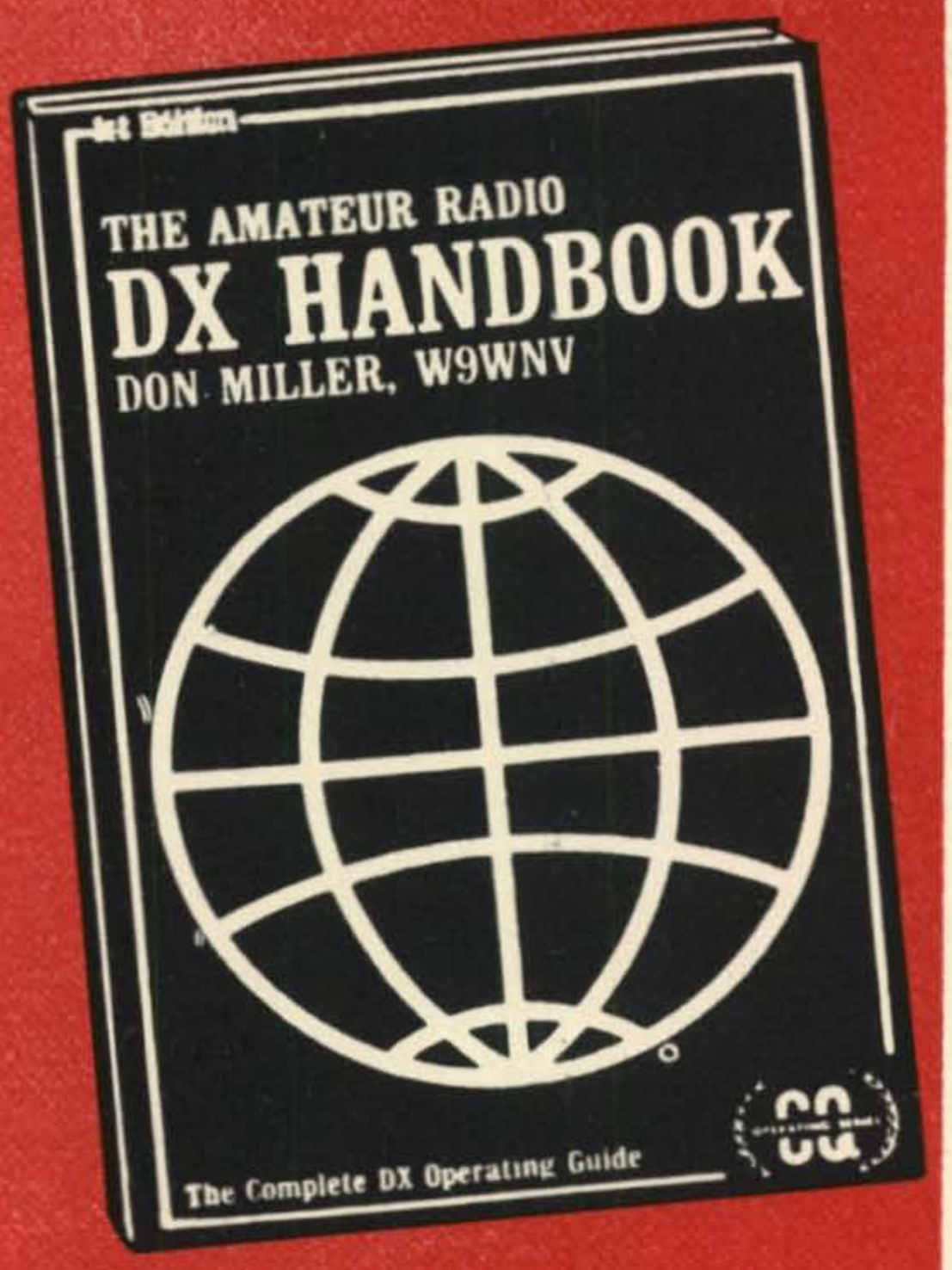
We appreciate the vote of confidence from those who feel that this action was long overdue.

In answer to the few who are of a different opinion. May I point out, disqualification and penalties are part of any sport, names are named and reasons given.

Amateur radio is an honorable hobby, but is it above reproach?

73 for now, Frank, W1WY

Here's what the DXer has been asking for!



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THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All Counties

#83—Raymond A. Vigneux, VE3CBY, 8-12-72.
#84—Gilmer V. Barber, W4IZR, 8-21-72.

USA-CA HONOR ROLL

3000		1500		1000	
VE3CBY	106	VE3CBY	195	VE3CBY	279
2500		K7CUY	195	W2GT	280
VE3CBY	138	W2GT	197	**500**	
2000				WA3LRJ	912
VE3CBY	162			G5GH	913
VE4QZ	163			WA5YSC	914

THE December, "Story of The Month," as told by wife, "Mona," WB6OOA is:

Benjamin F. Davis, Jr., K5YWX

(All USA Counties #76, 6-23-72)

"Ben, K5YWX, was born 18 November 1937 to two very proud parents, little did they realize they would coddle and love an avid radio operator.

"An interest in electronics began in high school when he worked as a television repairman after school. After graduation, he enlisted in the Air Force, hoping to further his knowledge in electronics. However, they trained him as a weapons mechanic — a far cry from his chosen field.

"He met and married Romona while attending school in Denver. In 1958, on a move to Belleville, Illinois, he was able to retrain into the electronics field. At that time, the big change in the lives of the Davis family came about. Ben received his Novice license — KN9QAO — and using a home brew transmitter with a 6AG6 and 807 final and an R100 receiver, spent many hours pounding out the code and talking to other amateurs.

"During a period at Biloxi, Mississippi, in 1959, Ben acquired his Conditional license — K5YWX — and became an avid talker.

"It wasn't long before Uncle Sam decided he needed Ben in another area, so he and his family — wife and daughter — packed up and moved to Morocco. Because of the rules and regulations, Ben was unable to operate from there. When he returned to Mather AFB, California in 1961, he again put up his antenna and started operating. It was while at Mather that he became interested in certificate gathering. His wife also received her Novice license there — KN6FGX.

"While stationed at Whiteman AFB, Missouri in 1963, Ben was tuning across the 40 meter band and happened across the County Hunters Net with K9EAB, K8CIR, K8KOM and W#MCX (just to name a few) and decided to join the fun. That was the start of it all!!!

"Now, some nine years later, Ben has finally gotten all 3079 counties. During those years, there have been tours of duty for Uncle Sam to Morocco, Philippines, and SEA where he was able to operate as HS3AEN from Thailand. He's gone from Conditional to General to Advance and his rigs have advanced from home brew to National to the Collins Line. Up to this point, he has never renewed any one license. In between the county hunting and mobile trips, he was able to study for and receive his FCC First Class Telephone License.

"His family — which has also grown, to two girls and a boy — and his wife, WB6OOA — have enjoyed the weekend trips of mobiling and the aggravations connected with county hunting, to give out the different counties including some on cross country trips on change of bases for the Air Force. Because

*P.O. Box 73. Rochelle Park, N.J. 07662

Ben Davis, Jr., K5YWX

of the constant operation, his son's first words were CQ CQ and has advanced to QRZ QRZ and he is now an expert in handling the mike. Another HAM is in the making.

"Ben has some very fine friends and lots of enjoyable company on his mobile trips. He would like to be able to thank every one of them for all the team work and effort that went into making County Hunting the big success it is today. He especially wishes to thank everyone for giving their time and efforts in helping Ben get his last county.

"I want to thank everyone too. Thank Heavens it's all over with. I can't believe it." Mona, WB6OOA.

Awards Issued

As listed in the Special Honor Roll, two more County Hunters made the top. Remember, starting with #85, a charge of $15.00 will be made to cover about half the cost of the Plaque. Those not wanting to pay the $15.00 can receive a *New Fully Endorsed Award* for $1.00.

Ray Vigneux, VE3CBY received #3 to a station outside the USA, and #1 to Canada. It was endorsed All SSB.

Gil Barber, W4IZR made the top, endorsed All Phone.

Doug Bowles, VE4QZ, who has been doing a lot of mobiling in the US, was happily issued USA-CA-2000.

Ray McGrath, K7CUY, from that city with the beautiful name, Snowflake, received USA-CA-1500 All Phone.

Larry Mitchell, WA3LRJ obtained USA-CA-500 All SSB.

Chas Emary, G5GH, Awards Custodian for the Radio Society of Great Britain, finally sent for USA-CA-500.

Dr. Bill George, WA5YSC had fun making USA-CA-500 All SSB.

Awards

Worked All California Counties: This certificate is sponsored by The Oakland Radio Club, Inc., and although there is no charge for the award, some of the rules are rather difficult.

Contacts may be made on any amateur band, any mode, and there is no time limit (check your old QSLs). A QSL must be presented for each of the 58 counties, and must be mailed from the county worked. All your contacts must be made from the same county. Portable and Mobile stations may be worked, but the QSL must be mailed from that county. Mobile stations cannot get an award.

It is suggested that your cards and list showing *County, Station Worked,* and *Town,* be sent via registered mail — no one would want to lose such valuable WSLs.

Send to: Charles Dumm, K6OXK (Chief Operator of the Club station, W6OT), 6102 Hillmont Drive, Oakland, California 94605.

Diplome Du T.F.A.I.: This new Awards is sponsored by the newly formed club of Djibouti, T. F. A. I., Section T.F.A.I., R. E. F. (R.E.F. is the *official* Amateur Radio Society of France).

Requirements are: QSOs with five FL8 stations

Some of the active FL8 stations on Field Day? L. to R. seated: FL8MM, 8NP and 8BC. Standing: FL8TS, 8NP 2nd, 8JA, 8DA, 8OM, 8NA, SWL and FL8HM.

since January 1, 1972, four must be on s.s.b. and one on c.w. Send the 5 QSLs and 15 IRCs to Marcel Meyzie, FL8AH, P.O. Box 702, Djibouti, T.F.A.I., East Africa. Officers of the club are: Pres. FL8HM; V.P. FL8DA; Sec. FL8AH; and Tres. FL8BC.

For those who do not realize it, since July 1967 the former "French Somaliland" has been known as "Territoire Francais Des Afars & Des Issas" (French Territory Afar & Issa) or T.F.A.I.

Diplome Louis Braille: As described, page 80 of September '72 issue of *CQ,* now has a U.S. Custodian/Manager; Phil Miller, WA2FJW, 501 Harcourt Drive, Elmira, N.Y. 14904 and he will accept 12 IRCs or $2.00. This award is sponsored by the French Club of Blind Hams called A.R.A.A.F.

Wheat City Award: Sponsored by the City of Brandon and the Brandon Amateur Radio Club, Manitoba, Canada.

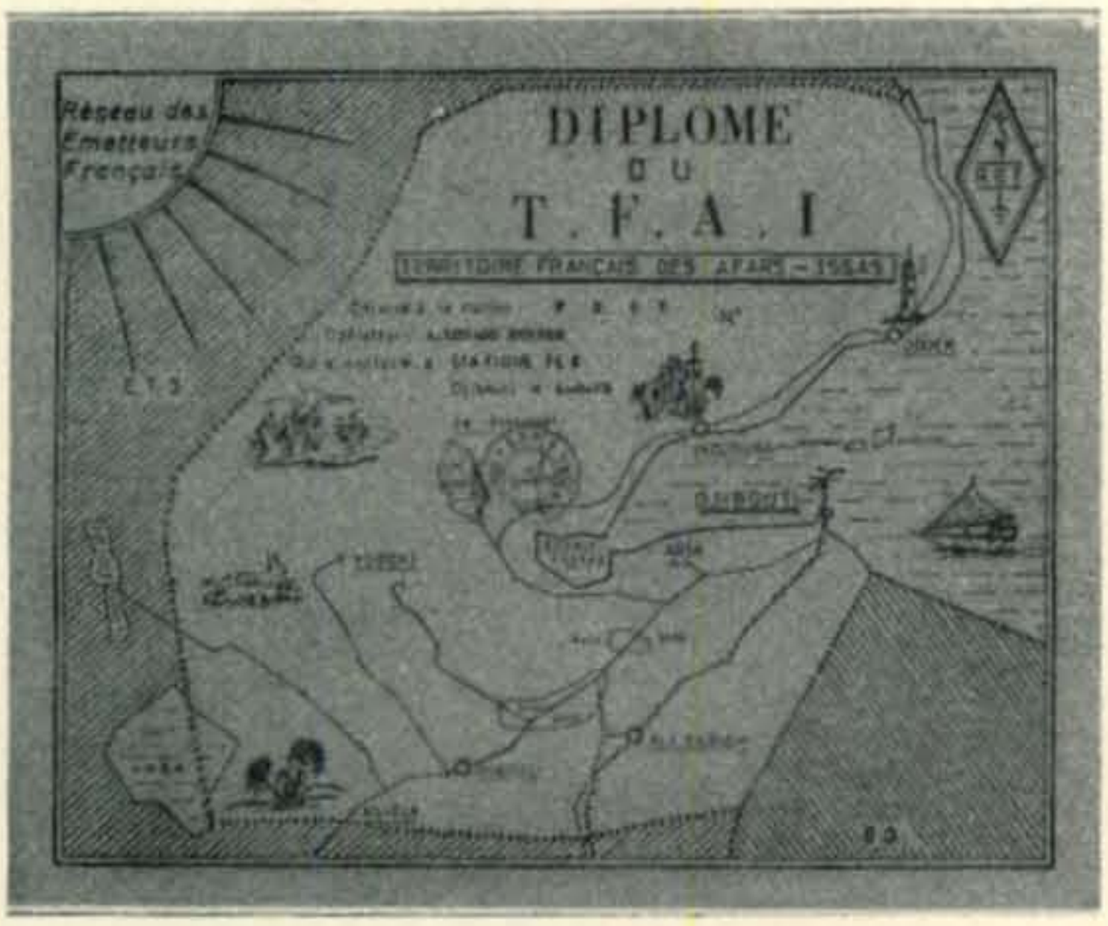
Starting January 1, 1967, work the required number of amateur stations in the City of Brandon, any mode, any band.

Stations in Canada are required to work 5 stations. All others, including U.S., Alaska and Hawaii are required to work 3 stations.

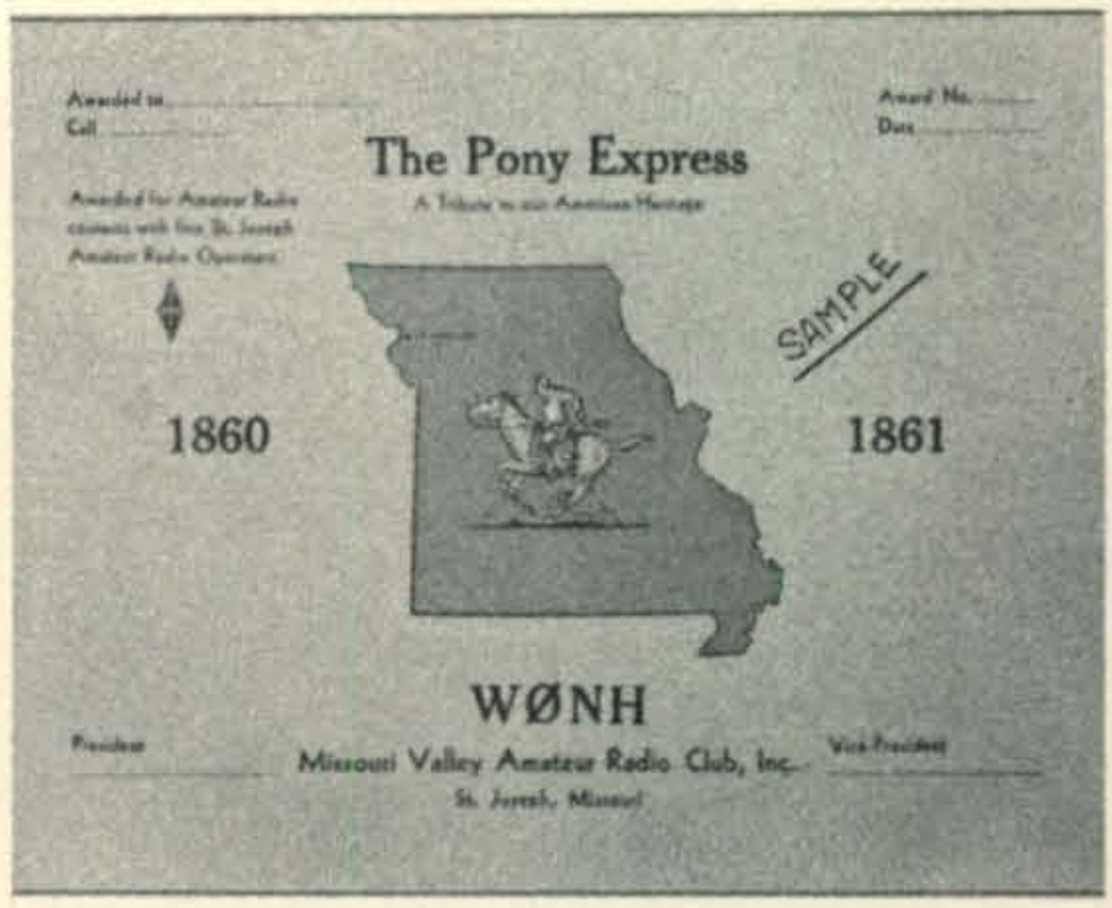
Send log data and 2 IRCs or 25 cents to: Doug Bowles, VE4QZ, 1104 First Street, Brandon, Manitoba, Canada.

Some of the active Brandon stations are: VE4AO,

Three DX County Hunters: L. to R. KR6IX (Doc, W5ROP All Counties #30), Roy, AZ1KG All Counties #52, (#1 outside US), Mark, ZL1TB (#1 USA-CA to station outside US).



Diplome Du T. F. A. I.



The Pony Express Award.

AU, BM, CI, CT, DI, DQ, EL, EP, FD,.FW, FT, JF, JJ, KN, LN, OM, OP, OZ, QD Club station, QZ, RE, RW, UP, XN, XY, YC, YP, and YW.

The Pony Express Award: Sponsored by the Missouri Valley Amateur Radio Club, Inc., of St. Joseph, Missouri (Club call W0NH).

Requirements: Contact 5 St. Joseph, Missouri amateurs and send log data to: Bob Martin, WNØGGD, 5107 Red Barn Lane, St. Joseph, Missouri 64503.

There are 6 Novice operators active and they can be found on 3710, 20, 30. 7158, 66, 70, 76, 80, 86. 21110, 120, 132, 150, 170, 177, 180, 200, 220 and 240. Their calls are: WNØHNO, DPS, DNE, DNC, HEF, GGD.

Notes

Thanks for the many letters that you have so kindly written about fast service on the USA-CA Award and the many telling how much they like the Award, one letter mentioned that of all his QSLs and Awards, the USA-CA Certificate is the *only* one he has on display! Wish I had room to print some of these letters, sorry I am unable to do so, at present.

Thanks to Bob, W2OST for this data, apparently some of the new County Hunters are sending their QSLs to the ARRL QSL Bureaus as listed in *QST*. These Bureaus do *not* forward/handle US QSLs to U.S. stations.

There are 3 bureaus that do handle county hunter QSLs, two have been mentioned many times in my column (including Oct. '72) but for data on them, send s.a.s.e. to: Jim Hoffman, K1ZFQ, 42 Gresham St., Milford, Conn. 06460, and WA2AEA, 4 Pinewood Circle, Corning, N.Y. 14830, and W6CCM, P.O. Box 146, Lakeside, California 92040.

Also for the newer County Hunters, if you ever hope to get QSLs from the Mobiles and other stations, on the Nets, who work hundreds of stations, you better get acquainted with the special County Hunter reply QSLs. You send these QSLs all filled-in with the data of the QSO, s.a. and stamped, so the station can easily check with his log, sign the card and drop it in the mail box — thus giving him a minimum of work. Due to the rising costs of materials and postage, I do not have the latest cost of these QSLs printed by WA2AMM; K7LTV and WA7MVY, but you can write them and send s.a.s.e. for the latest data. Have just received data on such cards printed by K9EMV and he sells them, postage paid to you, 500 for $4.50. Order from Win Hardisty, K9EMV, 116 Mercator Drive, Greenwood, Indiana 46142.

New *USA-CA Record Books* have been printed and all orders have been filled — the cost is now $1.00 (not $1.25) postage paid, but they are normally sent via special book rate and take a couple or more weeks to get to you. As all the back orders had included $1.25, the new books were sent via first class mail to make up for the delay in printing. The new books are smaller, but with the same amount of writing space in them and when completed (which is a *MUST* for your first application) they cost you 32¢ to send to me instead of the 80¢ for the old books. Oh yes, order the *USA-CA Record Books* direct from *CQ*, all other mail regarding USA-CA should be sent *direct* to my home QTH, to save time.

Sad to report to you who have not already heard, the passing of Mrs. Cliff Corne, Sr. (WA9DCQ XYL), Mother of silent key, Cliff Jr., K9EAB. K9EAB was the very first amateur to work All 3079 USA Counties.

Seasons Greetings for you and yours, hope "Santa" will bring you all the QSLs and presents you desire. Write and tell me, How was your month? 73, Ed., W2GT.

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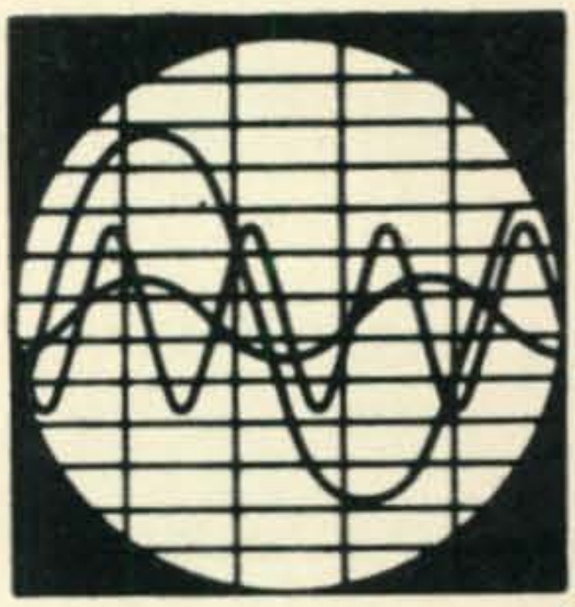

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TS-413/U SIGNAL GENERATOR 75KHZ to 40MHZ in 6 bands, precise calibration from 1MHZ Crystal Oscillator, has % modulation meter CW, or AM 400/1000CPS variable 0-50% and RF level meter 0 to 1.0V. Ideal for amateur, marine, aircraft and hobbyist for IF and receiver-transmitter alignment or development work..... **$89.50**

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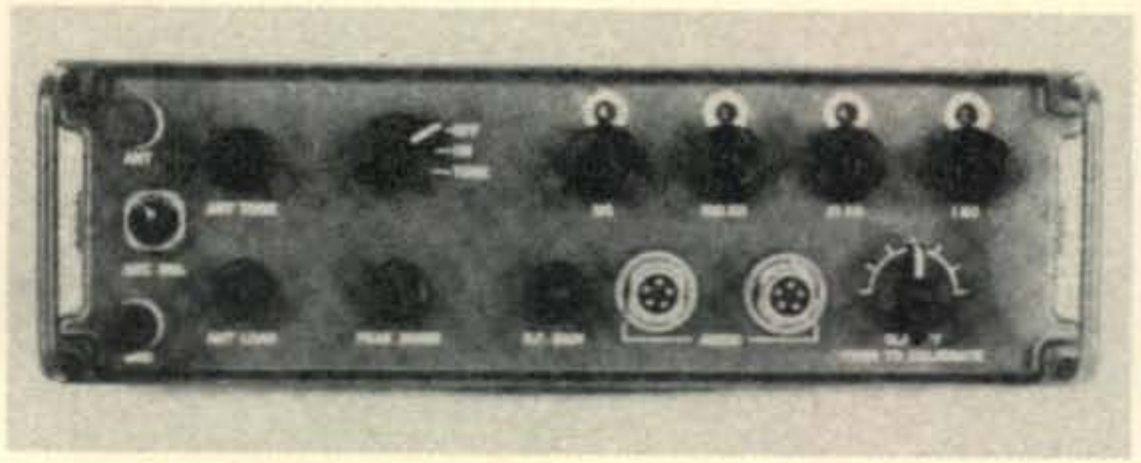


Front panel view of the AN/PRC-74 (HC-162-D).

BY GORDON ELIOT WHITE*

In writing this surplus column, I have had the problem of sometimes describing surplus equipment which is so old and commonplace as to be old hat to many readers. On the other hand, some items have, I know, been too exotic or so scarce as to be of little practical use to most amateurs.

In the first instance, I hope the old hands will be patient if I hit occasionally on familiar ground. I am sure there are newcomers to the surplus ranks who are not familiar with the AN/ARC-5, the SCR-522, or the R-390-A. I hope I can find enough of a new approach when going over the oldies to interest even the old hands.

When, on the other hand, I describe something rare, I hope those who can't find one in their local surplus shop will keep the item in mind, and look for it at the hamfests, or when taking that business trip to Los Angeles. At the least, I hope I can feel I am giving you an idea of the state of the art of surplus.

This problem of a shortage of good and interesting surplus is the reason we have tried to uncover and list as many of the surplus dealers around the country as we could find in a concentrated search effort last spring. I certainly hope that anyone I have overlooked will write and let me know about themselves.

Here are a few additions to the dealer list:

Newsome Electronics, Box 176, Trenton, Michigan 48183

Resco Communications, Box 463, Staten Island, N.Y. 10314

Andy Electronics, 6427 Springer St., Houston, Texas 77107

Golden Crystals, 2921 Loyola Dr., Davis, Calif. 95616

The surplus item I want to describe this month is probably in the scarce category, although it was turned up by a young experimenter at an eastern hamfest. It is the AN/PRC-74, a backpack high frequency transceiver, built by Hughes Aircraft Company, circa 1964. The set is a beauty, and may be found as the HC-162-D radio set — possibly by other nomenclature as well.

The PRC-74's dimensions, including battery pack, are 18 inches high, 12 inches wide and 3¾ inches thick. It weighs just over 14 pounds, less batteries.

The PRC-74 covers 2 — 12 mHz in 1 kHz increments, with enough vernier frequency range to interpolate between discrete frequencies. Tuning is via a four-dial synthesizer which is quite accurately temperature compensated and calibrated. Depending upon the quality of the crystals, it can be rated as stable as 1 part/million from -40 to plus 55 degrees C.

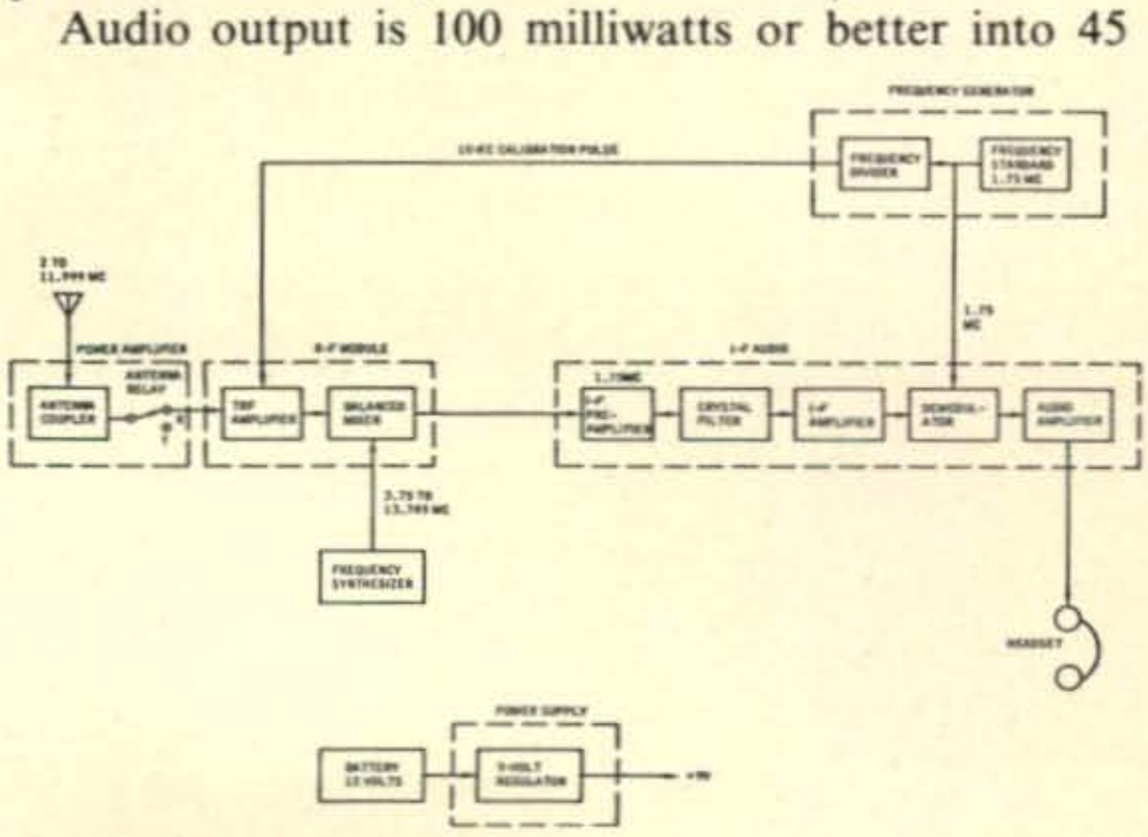
Modulation is upper sideband voice, c.w. or RTTY, and the intermediate frequency is 1,750 kHz. While it is rated at 12 volts from its battery power supply, the d.c.- d.c. converter in the set will accept from 10.5 — 17 volts and remain within operating specifications.

I tuned up one of these sets strictly cold, dialing in 5936 kHz on the panel, and WBR's weather RTTY came booming in on an antenna that was hardly more than a bent coathanger.

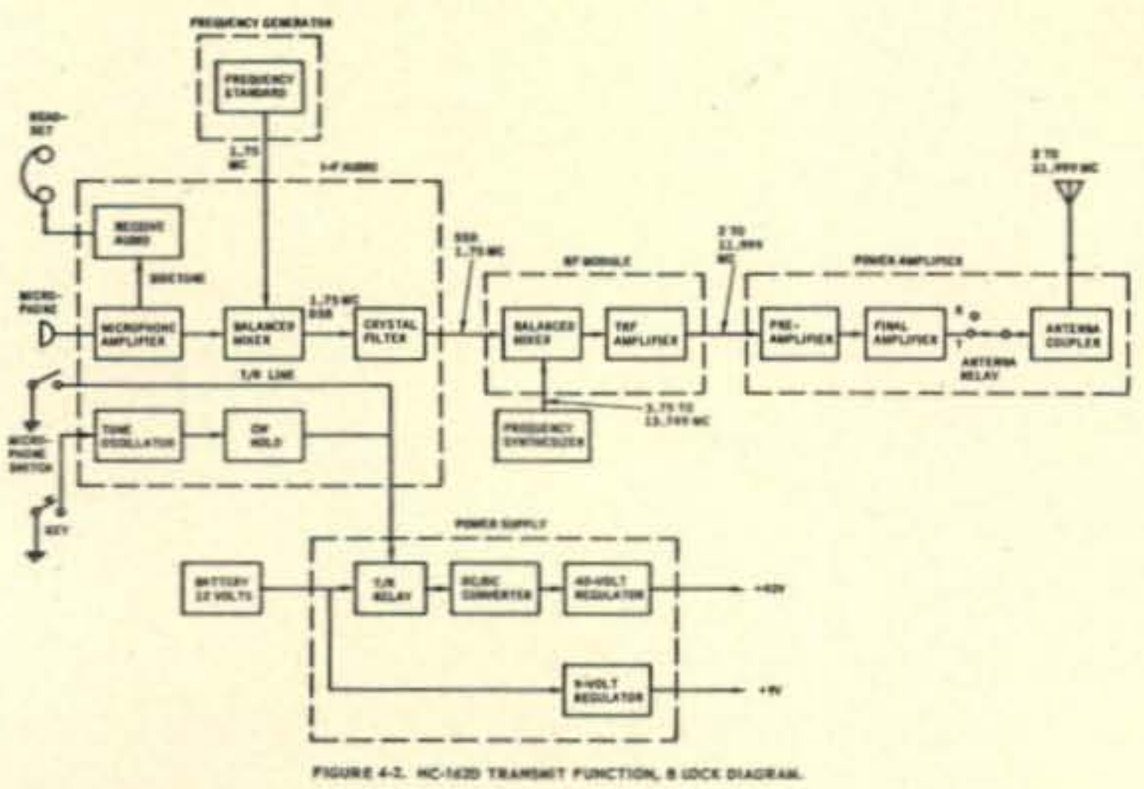
The battery pack is rated for a 24 hour life with continuous receive and a 1:9 transmit cycle.

Sensitivity of the receiver is rated at 0.7 microvolts for 10 db Signal plus Noise to Noise ratio. Selectivity is 2,400 Hz at 3 db and — 300 and plus 6700 Hz points, 60 db down (reference to carrier).

Audio output is 100 milliwatts or better into 45



(A)



(B)

Fig. 1—(A) Block diagram of the PRC-74 receiver, (B) block diagram of the transmitter.

*1502 Stonewall Rd., Alexandria, Va. 22302

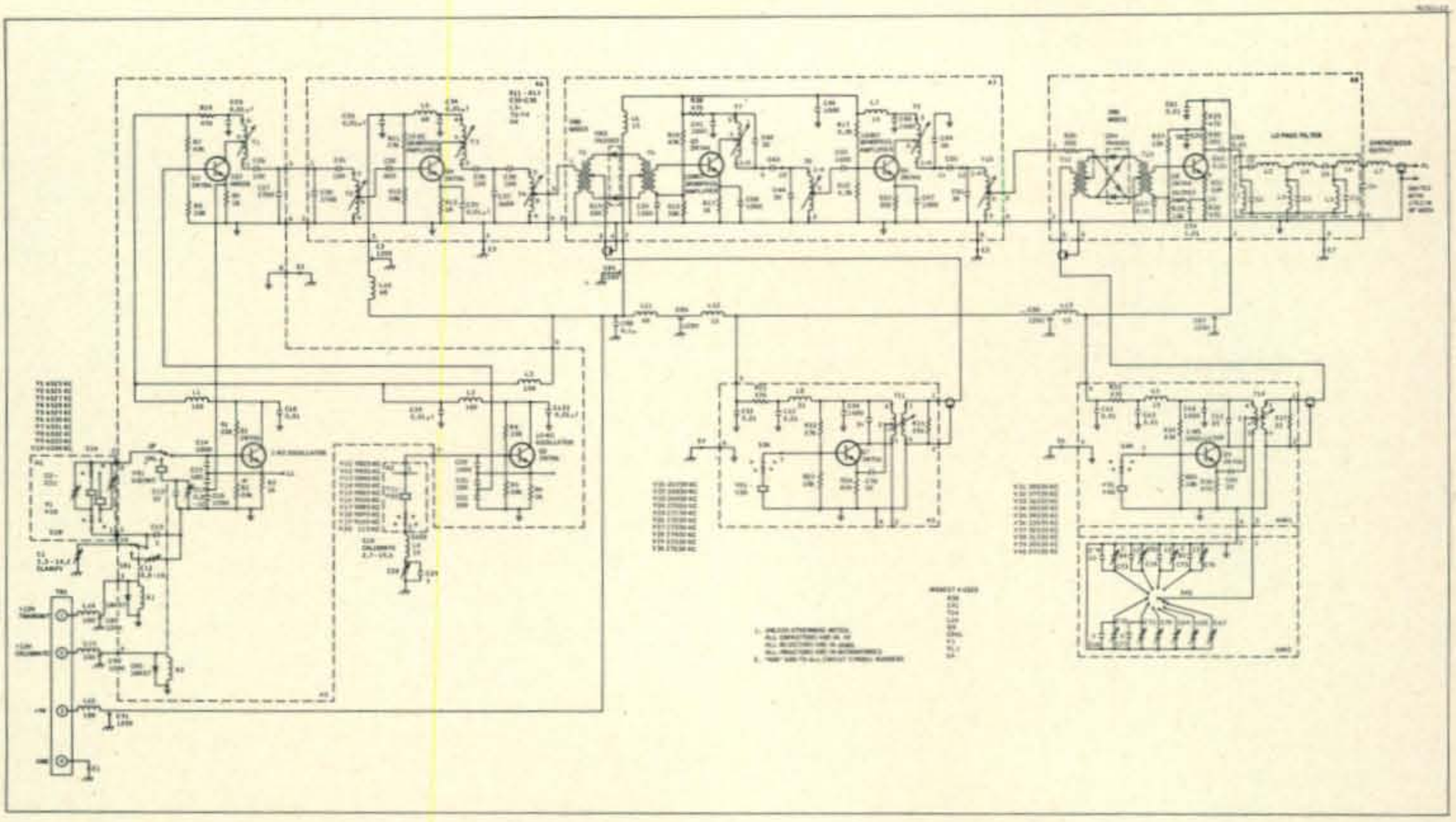


Fig. 2—Schematic of the PRC-74 frequency synthesizer, 40 crystals are required.

ohm speaker. The r.f. gain control has a 100 db range.

On transmit, the PRC-74 developes 15 watts peak envelope power, with a rated minimum output of 10 watts. Carrier suppression is rated 40 db down, and the set has a built in v.s.w.r. bridge for tuning the final.

Whip and long-wire antennas are normally supplied with the PRC-74, but of course such accessories are often lost before you find the thing in surplus. The 'phones, and the key, if desired, are attached by special front-panel plugs, which you will need to operate this unit. Remember, the PRC radios are combat sets, emphasising operating simplicity and ruggedness. There are no PL-55 jacks on this beauty.

Jim Karlow, of Potomac, Maryland, who found the set, has used it on several field day type operations, and his report on it is excellent. In fact he's looking for some more of them, although the PRC-74 is obviously highly attractive to the foreign military market, and may not be widely available in the U.S. as long as the dealers are snapping them up.

The controls ought to be self-explanatory. The frequency is set by tuning the four knobs at the upper right until the desired channel shows behind the indicator windows. By depressing the "clarify" knob, the frequency standard may be offset to calibrate it to an

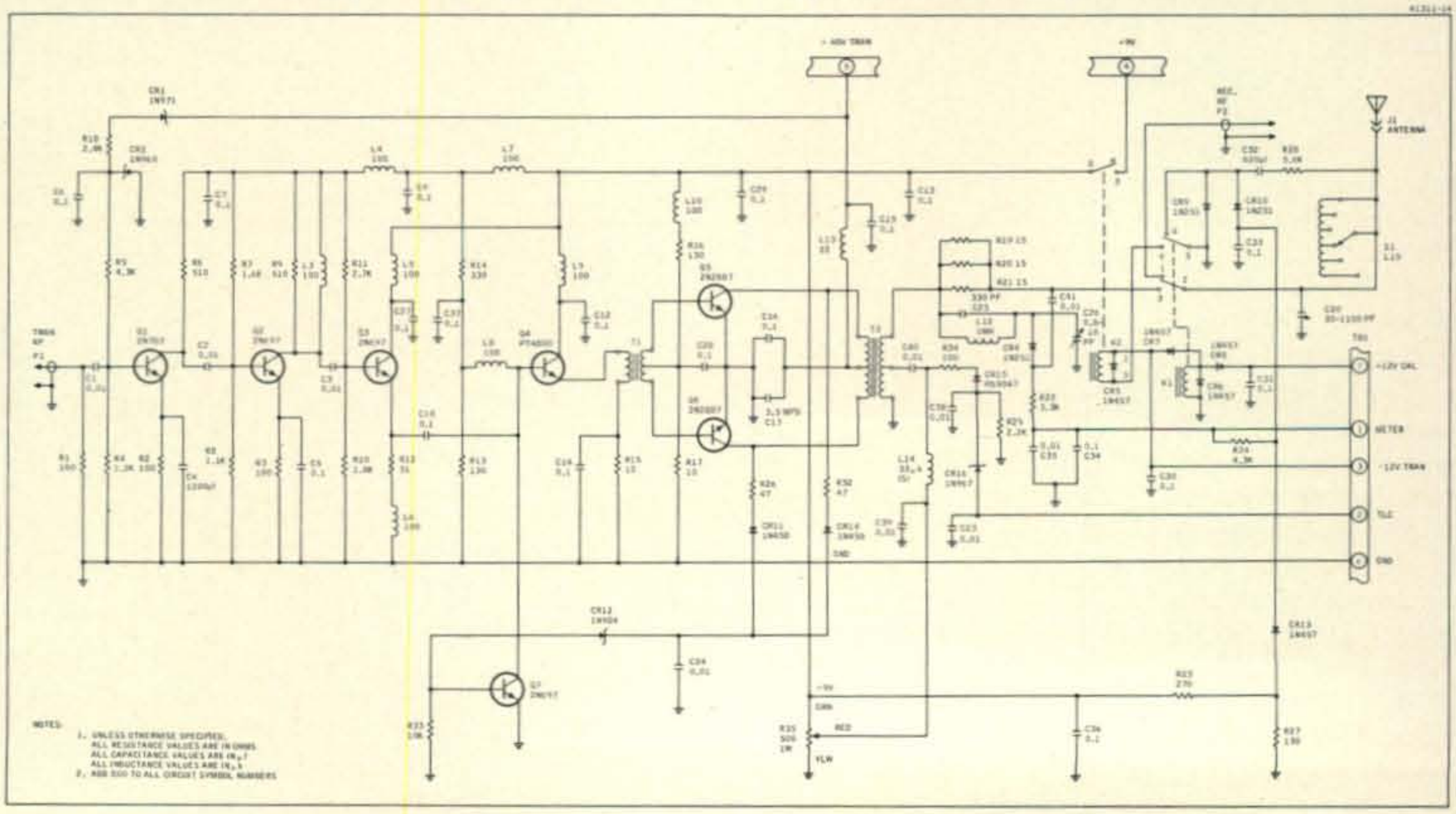


Fig. 3—Schematic diagram of the solid state power amplifier for the PRC-74.

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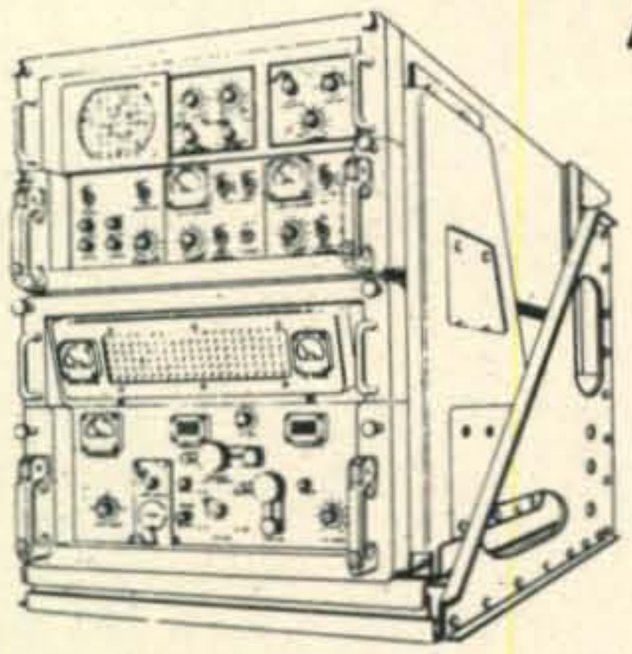

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additional internal frequency standard. (When not depressed the clarify control will provide enough offset to allow tuning of signals that are not on precise 1 kHz channels.)

The "peak noise" knob tunes the front end and r.f. circuit of the receiver, and the antenna controls obviously adjust an inductor and a capacitor in the antenna circuit. On receive they may be peaked on noise, like the "peak noise" control.

On transmit, with the on-off switch in the "tune" position, the antenna knobs should be "rocked" alternately until the highest meter reading is obtained.

Fig. 1 is a block diagram of the PRC-74 in both receive (A) and transmit (B) modes.

The frequency is determined by a 10-crystal oscillator for each of the four places — 1 kHz, 10 kHz, 100 kHz and 1 mHz. This requires a pretty good handful of crystals, and is one of the chief reasons the PRC-74 is obsolete. Synthesis is now done much more economically with phased-lock oscillators, but there is no denying the Hughes circuit works very nicely.

The set was one of the first to use solid-state devices all the way through the power amplifier, and since the output circuit and the synthesizer seem to be the most interesting parts of the rather large diagram, I am reproducing them here as figures 2 and 3.

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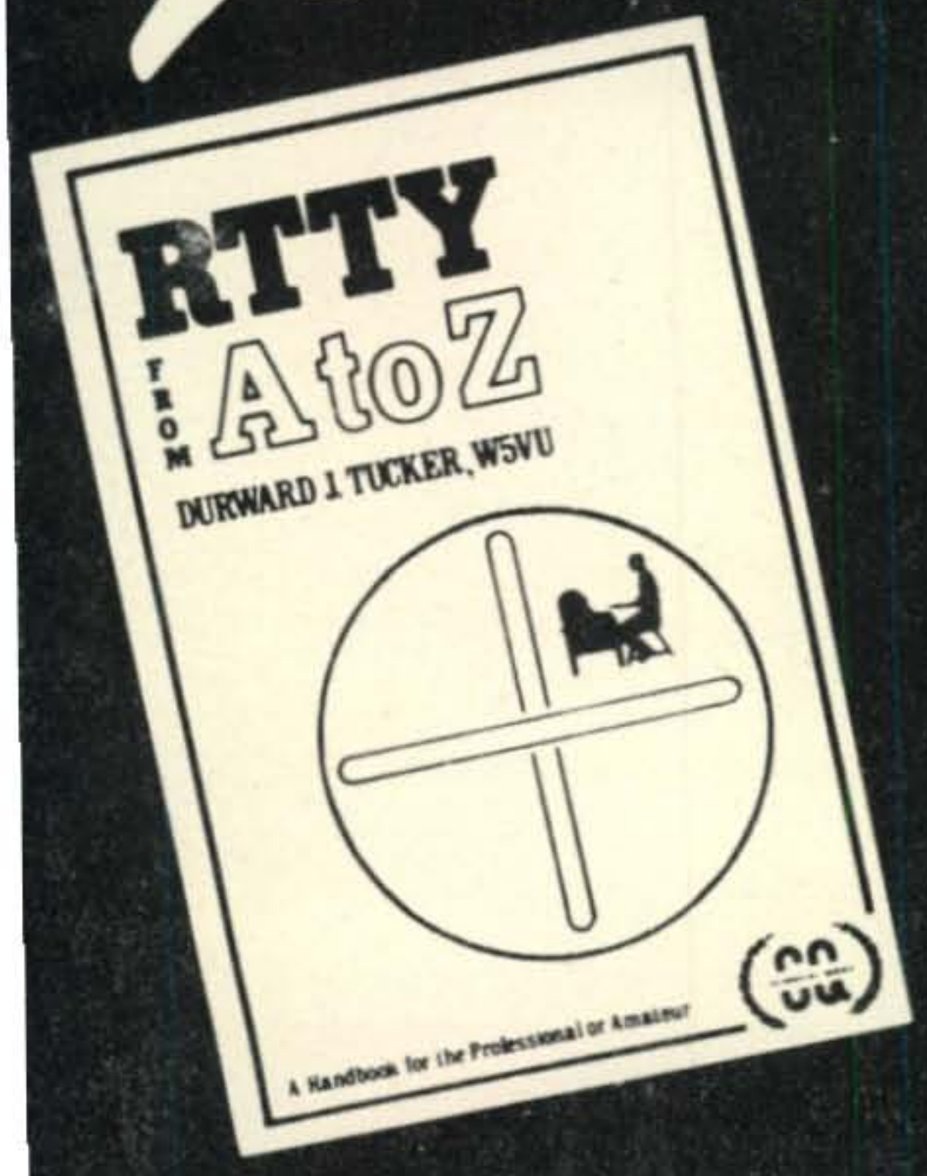

RTTY FROM AtoZ

DURWARD J. TUCKER, W5VU

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Written to round out the amateurs' RTTY bookshelf which up to now has relied solely on another **CQ** classic: "The New RTTY Handbook," the combination of the two is unbeatable. To properly describe the scope of this volume would demand a volume in itself, but the chapter headings below tell the story:

Chapter 1—**RTTY Basics.** Chapter 2—**The Teletypewriter.** Chapter 3—**Teletype and Radio Reception.** Chapter 4—**Converter (Terminal Unit) Basics.** Chapter 5—**Polar Relays and Distortion.** Chapter 6—**Special RTTY Circuits.** Chapter 7—**Test Sets.** Chapter 8—**Machine Adjustments.** Chapter 9—**Tape Printers.** Chapter 10—**Kleinschmidt Machines, Tape Readers, Teletype Models 28 and 32.** Chapter 11—**Codes, Data Processing & Advanced Machines.** Chapter 12—**Distortion Producing Test Sets.** Chapter 13—**Regenerative Repeaters and Frequency Shift Monitors.** Chapter 14—**Terminal Units.** Chapter 15—**The RTTY Station.** Chapter 16—**FCC Rules, Operating Procedures.**

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More Ham Bands *[from page 26]*

Propagation Characteristics

What will the new bands be like? If you have ever done any general shortwave listening, you already have a fair idea of what to expect. You might dust off that general coverage receiver, and explore those frequencies that may be yours someday. Keep in mind, however, as you listen, that commercial stations, especially short wave broadcasters, characteristically run very high power and have deluxe antenna installations when judged by amateur standards. Another way of anticipating what the new bands will be like is to note that they are located halfway between our present frequency assignments. As a consequence, the proposed 30 meter band will exhibit propagation characteristics intermediate between those we presently experience on 20 and 40 meters. The 12 meter band will be a hot daytime DX band during the maximum sunspot activity portion of the solar cycle.The 17 meter band will be an excellent DX band rivaling 15 and 20 meters. It will tend to be open for DX a little more often than 15 and somewhat less frequently than 20 meters over the sunspot cycle.

A perusal of the typical circuit analysis curves shown in figs. 2 and 3 shows the usefulness of the proposed bands at different times of day for both low and high sunspot activity. Through a good share of the sunspot cycle the 30 meter band will be an outstanding DX performer, especially during evening, night, and early morning hours local time. The convenience of these hours for operating will probably make it one of the most heavily used bands. As sunspot activity approaches a minimum during any solar cycle, the 5.25 mHz band will no doubt out-perform both the 3.5 and 7.0 mHz bands, and will exhibit particularly good performance during the popular early evening hours.

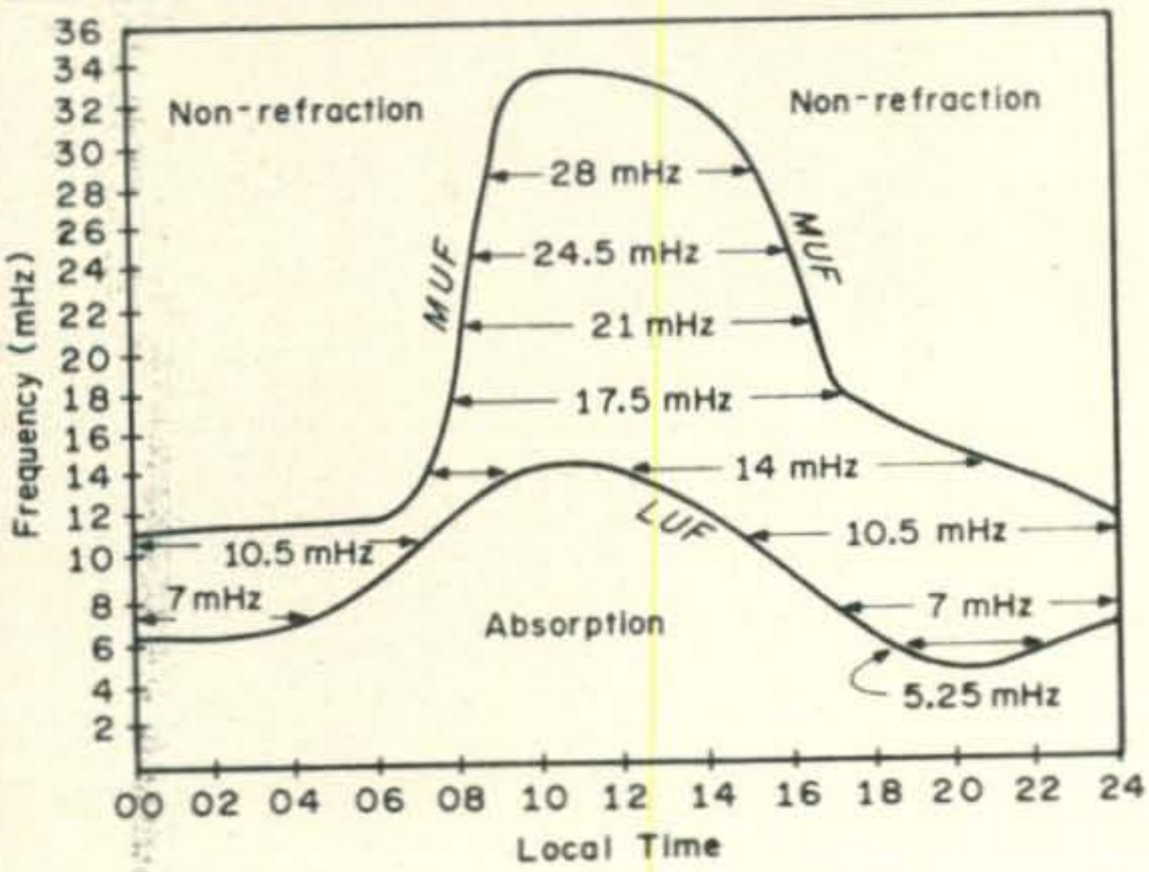

Fig. 2 — Characteristic m.u.f. and l.u.f. curves for a 3000-4000 mile path towards the east during a period of high sunspot activity — winter season.

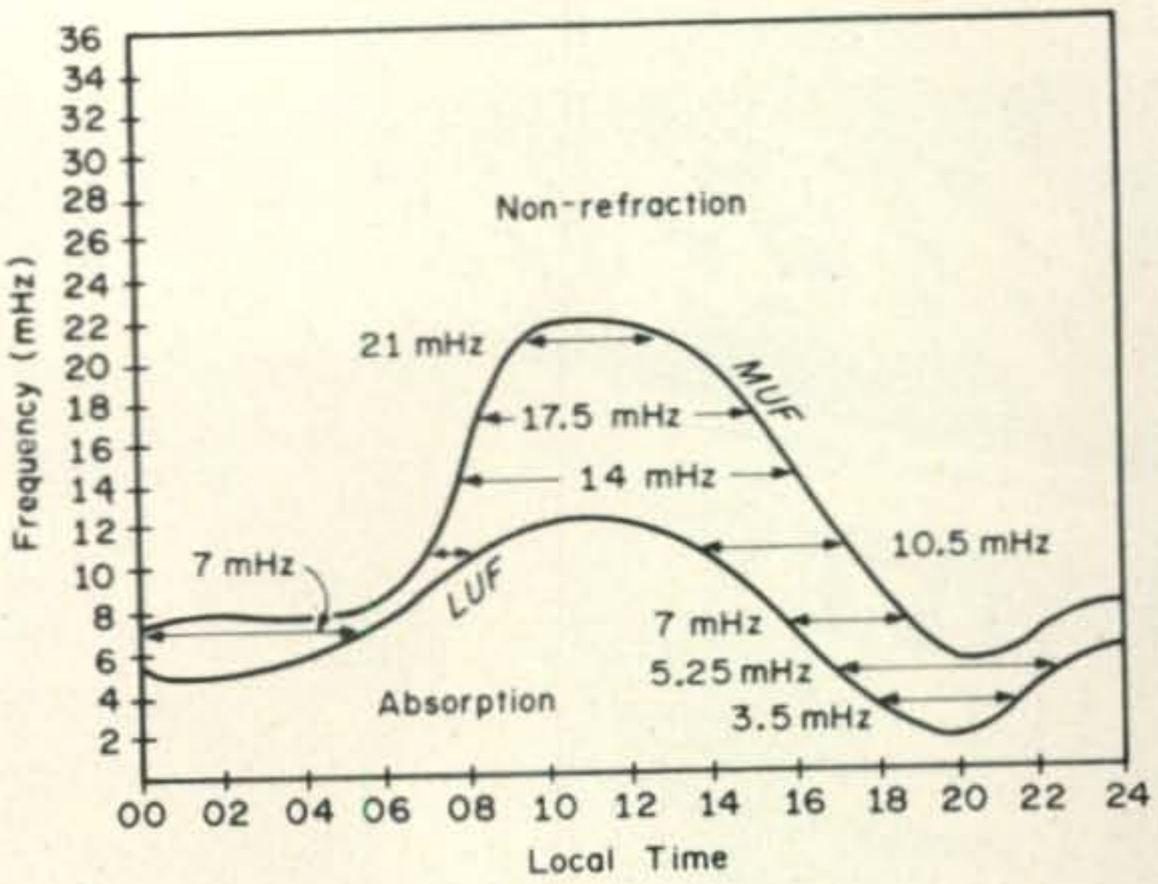

Fig. 3 — Characteristic m.u.f. and l.u.f. curves for a 3000-4000 mile path towards the east during a period of low sunspot activity — winter season.

Strategy

Now that I have whetted your appetite for more and bigger ham bands, we ought to discuss ways and means of getting them. What should our strategy be? International frequency allocations are never determined by the general public. Plebiscites and referendums just aren't used in determining international frequency allocation tables. This statement should not be interpreted to mean that we should in any way neglect the public service aspects of amateur radio, but the cold facts are that the key people who originate position papers and vote at the international radio conferences are most frequently administrator types, usually with technical backgrounds in communications. The highest level government people generally do not have much direct interest in such mundane matters as how the h.f. radio spectrum is carved up unless pressure groups have gotten to them, but if they do choose to become involved, they can be powerful friends or foes of amateur radio.

How can we make friends, patrons, and benefactors of persons in key positions? First, our best friends will be people who are active hams themselves. Furthermore, we need friends not only in the governments of the United States, Canada, and Western Europe, but around the world. The day is long past when North Americans and Western Europeans could dominate international radio conferences. Amateur radio needs friends in all countries. We probably can't do much more to create a positive attitude towards ham radio in eastern Europe and parts of Asia, but we could be doing much more in most regions of the world. If half of the effort we expend launching and participating in DX expeditions could

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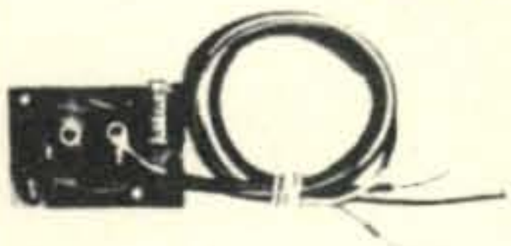

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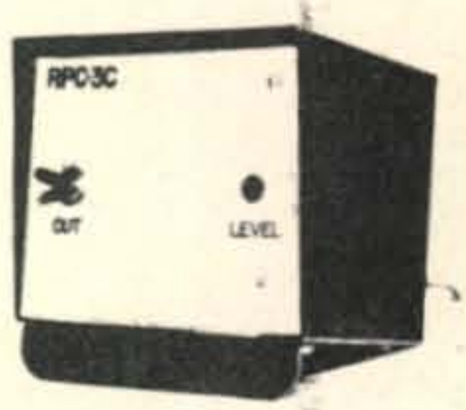

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be re-directed into establishing centers in schools and clubs in developing countries for the training of new hams, we would not only shortly have a lot more authentic DX stations on the air, but we would be developing the support for ham radio frequency allocations that we may sorely need in future years. The 15-year-old boy in Africa that we help today by providing him with the opportunity to learn electronics and to acquire some ham gear may well be the frequency allocations engineer representing Nigeria in the 1990 Geneva international radio conference.

Amateur radio can have a bright expanding future if we as amateurs will make the right decisions and take steps necessary to implement them in the next few crucial years.

Bibliography

Heslin, "Three-Band Log-Periodic Antenna," *QST*, June, 1963.

Brogdon, "Log Periodic Antennas," *CQ*, October and November, 1967.

Isbell, IRE Transactions, May, 1960.

Monser, "Practical Log-Periodic Antenna Design," *Electronics*, May 4, 1964.

Getting The Edge

[*from page 40*]

ing examination. You will be handed a card to send from, at approximately 20 w.p.m. Don't worry about hitting 20 exactly; strive for well-spaced, properly sent characters. Accuracy here is important, not QRQ. If you make a mistake, then send the mistake symbol, and continue sending. Take your time; relax.

As you can see, getting that little edge requires hardly more than the application of a generous amount of common sense, and you know you have that. So, relax. That Amateur Extra code exam is a cinch. ■

Vertical vs Horizontal

[*from page 31*]

made noise. The principal sources of noise then are internal receiver noise and galactic noise picked up by the antenna. Both of these noise sources are independent of antenna polarization. The result is a situation where the noise is independent of polarization but, as we said above, vertical polarization gives a slight advantage for the signal. Vertical polarization, therefore, should hold a slight advantage for the repeater uplink.

For the mobile-to-mobile operation both antennas are low and close to manmade noise. Under these assumptions vertical polarization will give a slight advantage, according to Dr. Brown. If the situation is such that external noise is very low — such as a mobile parked in an open field, where receiving noise is the limiting factor, vertical polarization will give a considerable advantage, however.

We can summarize the preceding material by saying that when the transmitting antenna is high, and the receiving antenna is low and in a noisy environment, such as v.h.f. broadcasting or a repeater downlink, horizontal polarization will give a better signal-to-noise ratio at the receiver. For mobile-to-mobile operation or a repeater uplink with the repeater receiver in a quiet location, vertical polarization will give the best signal-to-noise ratio.

Summarizing, we have shown that the optimum system configuration for repeater operation from a propagation point of view would be to use horizontal polarization for the downlink and vertical polarization for the uplink. However, in any repeater system there are many factors to weigh besides propagation simple as possible even to the extent of complicating the repeater hardware. Since vertical polarization is preferable for the repeater uplink as well as mobile-to-mobile, it appears that the mobile should be vertical; also it is hard to beat a vertical whip for economy and esthetics. Any loss this causes in the repeater downlink can easily be compensated by increasing the repeater power slightly. We have also shown why horizontal polarization is used by v.h.f. broadcasting.

And so, good reader, if you have come this far, you deserve a beer — drink heartily! ■

Letters

[*from page 7*]

the east coast first? You can work that anytime." "Why do I have to wait so long to work this station?" or "Why are you working the west coast first?" and a long list of other gripes.

Of course you hear the same poor operating when the DX station is working someone. Another station calls on top of him and keeps calling. If the DX is asking for the first district, someone on the west coast will call anyway because he doesn't want to wait, or because he thinks he's special.

No one waits anymore for "73 and QRZ" from the DX station; instead they just start calling after the stateside station has said "thanks and back to you for a final." It's one big mess after another and I really don't blame anyone for not taking expeditions, or for not working W/K's.

My praises instead go to organized nets such as the YL system and the African net, where a net control takes command and offbeat ethics are not condoned. I like to DX, and maybe I don't have 300 plus (only 205 as of this date) but because I don't have 300-plus, I don't feel that the world will end.

I think if more people read the excellent article a few issues back ["Tips On Working DX," *CQ* June '72, p. 24] it would certainly enlighten a few individuals about how to operate.

William L. Hilyerd, K4LRI
Henderson, Kentucky

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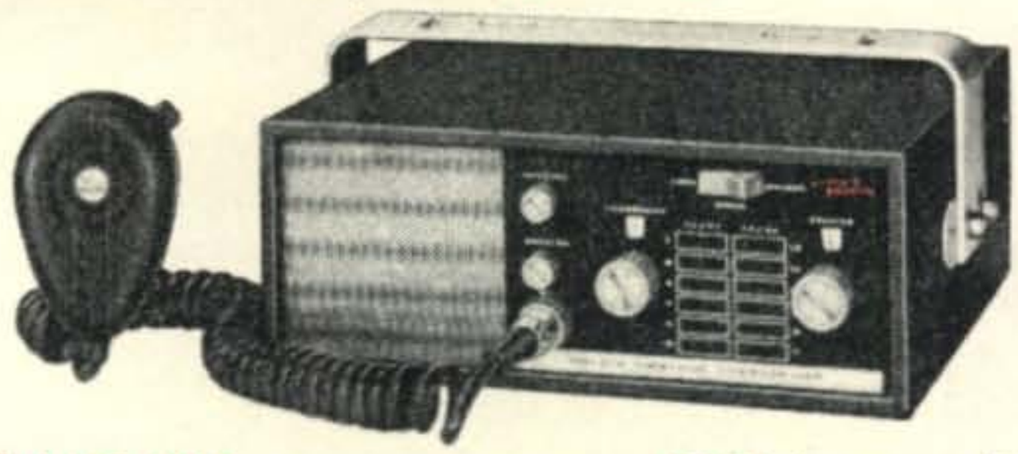

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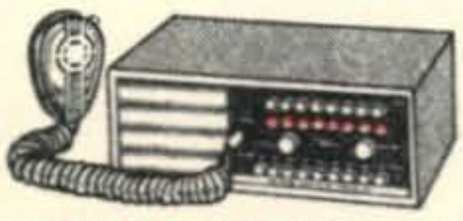

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similar equipment. The approximate signal level at the i.f. for full limiting is 200 microvolts.

The final circuit is not really a circuit at all, but a suggestion from this columnist on obtaining power for transistorized preamps. As has been mentioned in this column before, an excellent source of 9 to 12 volts d.c. in a tube-type receiver is from the cathode of the audio output tube. The high-fi manufacturers used to use this for d.c. on the low level audio amplifier tubes to eliminate hum. It also works quite well for preamp power. Although the first mention was for powering solid-state multi-frequency oscillator decks, the idea carries over into the pre-amp problem. Why worry about batteries when that +9 to 12 volts is already available and waiting to be used.

Tone Controls

W5SWY and W6GDO have pointed out that there is nothing in the present FCC regulations which prohibit use of tones above 3 kHz in control circuitry as has been mentioned several times in this column. A check with the FCC by W5SWY confirmed this. The original restriction of 3 kHz tones was given to this author by a usually reliable source based on 97.69(d) governing RTTY. Looks like I blew it. Until corrected by higher authority, would say that use of tones above 3 kHz are permissible.

Open Repeater Definition

Jay O'Brien, W6GDO, requested that this column publish the CARC (California Amateur Relay Council) definition of an open repeater. This definition has been adopted by the ARRL and included in their repeater directory.

"An open repeater is one where used by any properly licensed amateur is encouraged. Frequent users may in some cases be expected to join the repeater organization or otherwise provide support to the continued operation of the repeater. An open repeater may require access tones or codes (not to be confused with control tones or codes) if these tones or codes are made generally known. All repeaters operating on nationally or locally recognized 'open' frequencies will be considered to be open repeaters."

This columnist agrees with this definition with the following addition: Any repeater using continuous tone squelch (such as "Private Line" or Channel Guard) should be considered "closed" repeaters whether or not the coding is made known. The reasoning behind this is the complexity of CTS is such to be outside the realm of an "easy" technical project for most amateur f.m. operators. Single tone or "tone burst" encoders are relatively inexpensive to build and calibrate due to the wide bandwidth of single tone decoders in general use. However, CTS requires an accurate tone (usually no greater than 0.5% frequency variation allowed) and are therefore much more difficult to build, calibrate, and to install properly. CTS systems use tone frequencies below the cutoff frequency of the shaping circuits in f.m. transceivers (300-3000 Hz range). Therefore, the subaudible tone encoder must be installed after shaping and cannot be fed directly into the microphone connector as can single-tone in the 1800-2400 Hz range.

Please excuse the editorializing in the NEWS portions of the column. However, since news was light this month, it does take up some space.

Regency 6M FM

With the filling of 2 meters in most parts of the United States the trend has been upwards to 220 mHz and 450 mHz. This onward and upward trek has left the 50 mHz band all but deserted in many areas. Lack of obsolete low band equipment has not been a problem, but lack of ready to go solid-state f.m. gear has. Well, Regency is trying their best to promote 6 meter f.m. activity with the introduction of a new solid-state f.m. unit designed specifically for the amateur market. This unit will be examined in depth in a later review, but the advanced information is contained herein.

Finale'

The second year of the FM Column is rapidly coming to a close. Beginning next month, a small portion of each column will backtrack with a repeat of technical material (test procedures, etc.) which are known to those who have been on board, but are unknown to the brand new f.m. operator.

Reasoning behind this move is simple. Those of us who have been active on f.m. for several years are much ahead of the newcomer. Even the operators who started out with the beginnings of this column have two years under their belts. So, it is only fair to contribute some space to helping the f.m. operator who is new to the game. Covering both extremes of experience along with the middle makes preparation of the column even more difficult. However, it must be done to enlist the help of the new readers and to keep the support of the long time readers as well.

Everyone can help. As usual photographs are always in demand. News of local and regional f.m. activities is also needed. Repeater Directory update and new listing information helps immensely. Finally, suggestions and comments as to projects, reviews, and discussion topics are openly solicited. Thus, all that is remaining for December is to wish everyone the happiest of holidays and a very very good new year!

73, Glen, K9STH/5

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The Erickson Communications ad on page 41 of our November issue features several excellent close-out bargains. Unfortunately, some gremlins invaded our ad stripping department and featured the brand new Standard 146A instead of the model 146 which is the discontinued model. We apologize to Erickson for the hundreds of letters they'll be getting and having to answer, and to our readers for similar inconvenience on their end. At any rate, the model 146 is quite a bargain at $229.95, and we hope our readers won't be sore at the advertiser, since they really weren't at fault.

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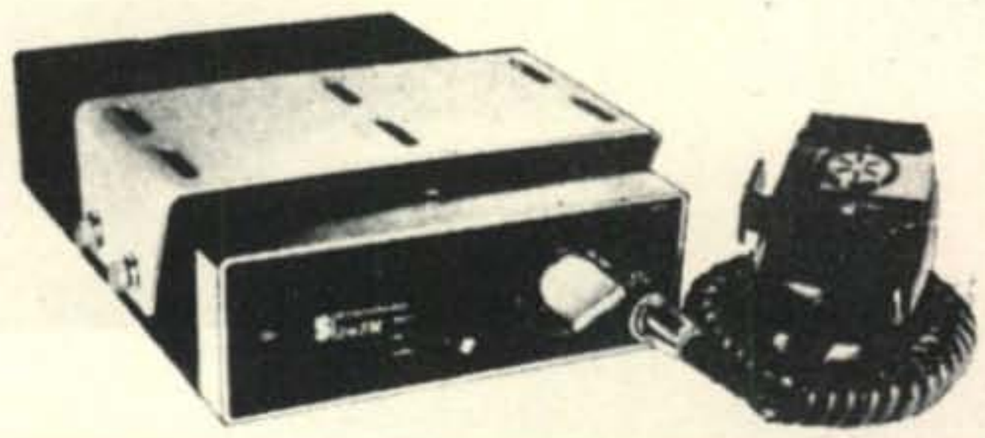

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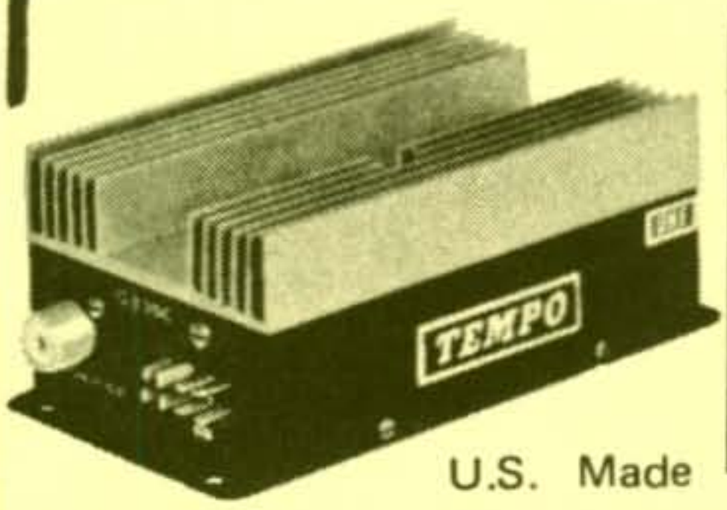

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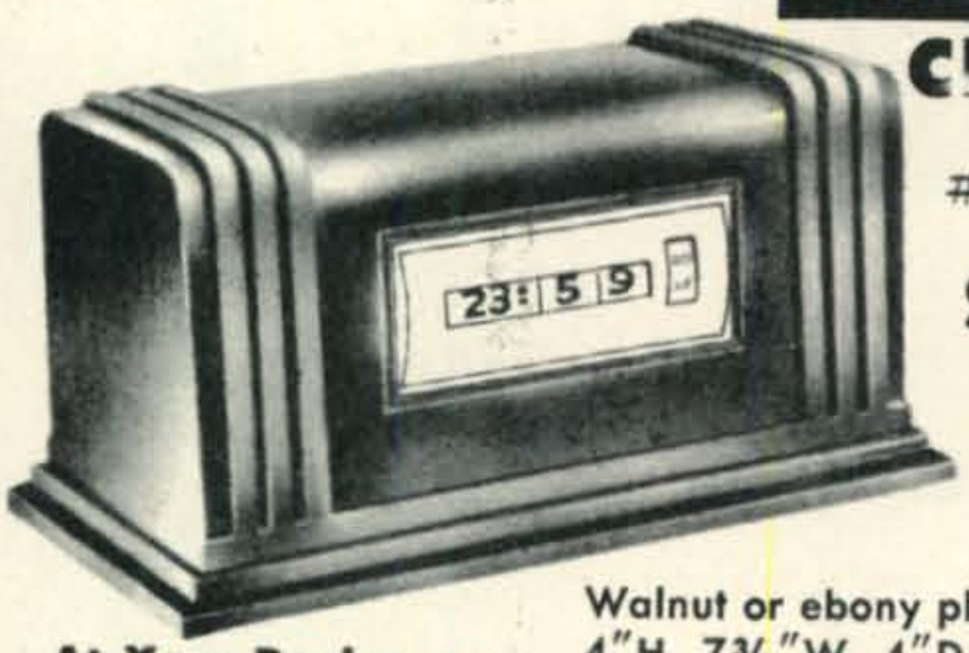

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SSTV [*Continued from page 46*]

as a few seconds of heterodyne QRM, or an abrupt change in phase such as occurs with "scissors editing" of SSTV programs. The lock-in time and noise performance can be varied by proper circuit design procedures. Unfortunately the tradeoffs are such that designing for the narrowest effective noise bandwidth generally gives a longer than desirable lock-in time.

How does one test for these things? Again, the optimum tools don't exist at the moment. It would be nice to have a test pattern signal with controlled amounts of noise and QRM added. A home brew tool that should help in evaluating and comparing sync and sweep circuits would be a short edited tape containing segments of "good copy" signals from a U.S. station, a foreign (50 Hz area) station, and various segments of "poor copy" signals.

Q & A

QUESTION: I am building a flying-spot scanner. Where can I obtain inexpensive lenses and other optical supplies?

ANSWER: The photographic magazines on the newsstands carry ads for used camera and enlarger lenses. The enlarger lenses, if designed to cover the area of your image source, make excellent FSS lenses. (An enlarging lens designed to cover 35 mm film will not work for 3¼×4¼" snapshort for example) One of the very best sources for inexpensive optical material of all kinds is Edmund Scientific Co., Edscorp Building, Barrington, N.J. 08007. They have an excellent free catalog.

73, Cop, W1GNQ

Math's Notes [*Continued from page 54*]

this information with all readers. This is, after all, one of the functions of this column. The same is true for various surplus dealers. There is no charge or obligation — as long as the items are of general interest to amateur radio operators.

Best wishes to all of my readers for a very happy and healthy holiday season and coming year.

73, Irv, WA2NDM.

Q & A [*Continued from page 16*]

Sticking Meter

"What is a quick cure for a meter whose needle sticks intermittently?"

A meter with a mechanical defect usually requires a little rap to bring the meter back to zero. An intermittent stick (if it stops at the same spot everytime) indicates misalignment — the major cause of sticking.

Some meters are hermetically sealed and there is little one can do except send the meter back to the manufacturer or replace the meter.

If you know what you are doing and can disassemble a meter, first look for a fleck of metal or dust. *Don't* use air to blow out the meter! Next, carefully push the needle towards the maximum position with your finger to see if it springs back. If it stops at the intermittent "point" do not force it. If the meter is truly free a small puff from the mouth will push the meter needle over and it will return quickly. When a meter has been slammed by over voltage or current, the needle can be bent — check its linearity. Check the spacing between meter

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Edited by Art Seidman, a 160 page mass of antenna information directed at answering a multitude of questions surrounding the mysterious antenna. $3.00

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No reason at all.

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"I live near a bc station. After installing my 3 element 20 meter beam it is *h-o-t* with r.f. from the bc station. No need to say that my receiver receives nothing *but* the bc station! I tried a trap — no luck. Any cure?"

RF saturation is hard to cure, and I'm sure that is what you have. I'm sure the bc station uses a vertical (as most do) but the signal is so strong from the bc that *no* receiver made can cope with it. Sorry I can't help.

Ranger & dsb Problem

"I converted my Viking Ranger to d.s.b. operation. After my conversion I got good reports, then later on no s.s.b.'er wanted to talk to me because my signal was so bad.

"When I converted, I installed two 6146's in the final, fed their grids in series and paralleled the plates. No big changes but my set worked.

"What do you think may be wrong?"

First check the 6164's — they must be matched. Next, check grid drive (don't overdrive). Load the final lightly and give her a try. (I'm sure you must have installed one of the 6146's outboard — make sure that you use good *coax* wire connections from the outboard stage to the transmitter (except for the heater supply). Check ground connections.

—30—

It is nice being back with *CQ*. A Merry Xmas and a wonderful 1973 to all my old and new readers.

73, Chuck, W6QLV

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New WAZ Award [*Continued from page 58*

Zone 39. Madagascar Zone: FB8, 5R8, FR7, VQ8, VQ9, and VK0-Heard Is.

Zone 40. North Atlantic Zone: LA-Jan Mayen, LA-Svalbard, OX, TF, and UA1-Franz Joseph Land.

The UA9 and UA0 Zones are sometimes rather hard to determine. However, the DX column in the August, 1968 issue, pg. 82 has a handy table to use in locating stations in these zones.

JUGE

Merry Christmas

Happy New Year

And Many Thanks..

. . . to all of you for making 1972 our biggest and best year yet! We must be doing something right . . .

A San Francisco ham writes after several orders "You have the best-stocked ham store in the San Francisco Bay area!"

A QWCA member from Dallas says "So far I have received better service and what I think is better equipment than from any previous dealer."

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– A Houston customer orders by phone, we ship to his neighborhood bus sub-station, and his orders arrive the day after he calls them in. He says he much prefers this to making trips downtown.

What we're saying with this "horn-blowing" is that perhaps those skeptical Amateur dealers who claim the business is dying, ought to take a look at themselves and see if perhaps the dead item is their interest in going out of their way to serve their customer. Of course we'd also like to entice you to try us next time you buy or trade equipment. How about it?

Our sincere wishes for the holiday season.

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DX [*Continued from page 63*]

that he has *no* QSL Manager and all QSL's should go to the address listed in the QSL Information Section. — September activity of FØWV/FC was operated by members of the Belgium Air Force Amatuer Radio Club. — We sadly report the death of Rafi, 4X4AE, who was one of Israel's longtime amateurs.

QSL Information

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FP8DH — Box 189, St. Pierre and Miquelon
HM1AQ — POB 152, Seoul, Korea
HS1AHE—JUSMAG, Box 149, APO San Francisco 96346
JY5HC — POB 2353, Amman
JY9VO — BOX 5089, Amman
KR6AY — Hq Sq 18TFW, Box 11007, APO San Francisco 96239
OA6AQ — Via K3AXW/5 3125 Melbourne, Fort Worth, Tex 76117 or Casilla 303, Tacna, Peru
OD5GT — POB 2068, Beirut
PYØDVG — PY1DVG POB 51, — ZC — °°, Rio de Janeiro
SV1EN/P — POB 1442, Athens
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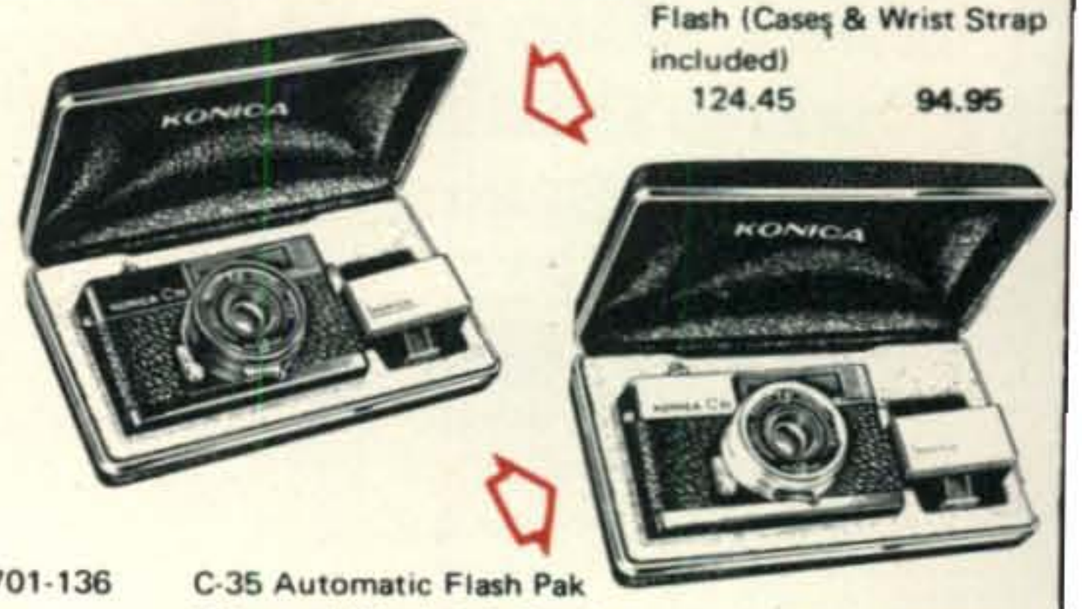

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HALLICRAFTERS HT-37, mint condx - $194.9 Also, Hallicrafters SX-111 - $145.00. Marine El tronics, 76 New York Ave., Halesite, L. I., N. 11743. Phone 516/427-7199.

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Complete 2-Meter Station: Regency HRZA Power Supply. Hustler Mobile 5/8 wave antenna, Cushcraft 4 Pole all new, $285.00. Takes all. WB5GYT Mike Boger, P. O. Box 978, Miami, OK 74354

NEED CODE HELP TO PASS GENERAL. Will pay for tutoring. Chris Sheridan, Yonkers, NY. (914) 968-3019.

SELL: HT37 $165.00, BC348Q $37.50, NC183D $37.50. All working, K4CN, Rt. 2, Palmetto, FL.

FOR SALE: Henry 2K-3 Linear. Positively mint condition. Motorola "Business Dispatcher" 2-meter FM, 15 Watt, 2 channel. QST 1961-1969. CQ 1961-1969. 73 1960-1967. Send for list. A. Martinka, 157 W. 150th St., Harvey, IL. 60426.

WANTED: A220-V Variac. What have you? W6FPH Bud B. Ballard, 558 "A" Street, Yuba City, CA 95991.

GIVE AWAY SALE: HW32 $60.00, HWR $50.00. HA14 Mobile Linear (2) $60.00 ea. HW12 $50.00. HP23 $35.00. HP24 $35.00. Unique Tuner $30.00 Johnson Viking Matchbox $40.00. Hustler Mobile Whip Set 10-80 $30.00. N.I.S. Signal Generator $30.00. All in perfect condition. Must be picked up. No deliveries. 212-595-6096. WB2HHR.

WANTED: Yaesu 570 or 101 or Hallicrafters FMP 200, like new. Cleveland area. WA6QHB, 190-B Higby Dr., Stow, OH 44224.

SELL: Hammarlund SP-600 mint cond. $275.00-Collins J51-3, mint cond. $275.00. Both with original speaker. Sonar BR-21 Linear amplifier, never used, $60.00. Astatic Mike D-104, with stand, new $20.00. Sonar Communication Power Mike $10.00 Call days in Flushing, NY. (212) AX7-0100.

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Sell: Heath HW17 2mtr xcvr complete $75, R.B. Fairchild, 1217 Hacienda, Sun City Center FL

Deskfax facsimile machine works ok $5 pickup. Goodman, 5826 S. Western Av, Chicago, IL 60636

CO Model 76, cap/resis bridge/sig tracer. Price to sell. Details, WB4SPT, 240 Colony Rd, Jupiter FL

Schematics & service info for most BC rcvrs 1921-, cpys $1 ea, send yr & model SASE WA7NUZ, PO Box D, Springfield, Ore. 97477

MAGAZINES QST 42-72; CQ 46-72; Radio News Radio Electronics, 73, Ham Radio-1000 mags. Make offer. Duport, 15 Fitchdale Ave., Bedford, MA 01730.

SALE: KWM1 with power supply. Need FTDX or familiar or Swan. WA6SNC, P.O. Box 26296, San Francisco, CA 94126.

SELL: novice HB xmtr 35W 4 xtals builtin ant relay. $13 I ship. WA3LPK, Kevin McKewen, 2300 Louise Ave., Baltimore, MD 21214.

Brand new, never used, Lafayette HA 410 ten mtr transceiver $130. W9DJW, RFD 2, Lebanon, Ind. 46052.

SELL: Gonset GSB-100 xmtr. Hammarlund HQ-170C and HQ-170C A-1, Manuals. Want: Heath SB-310, Swan 406B, CE20A. Peery, Box 313, Trenton, MO 64683.

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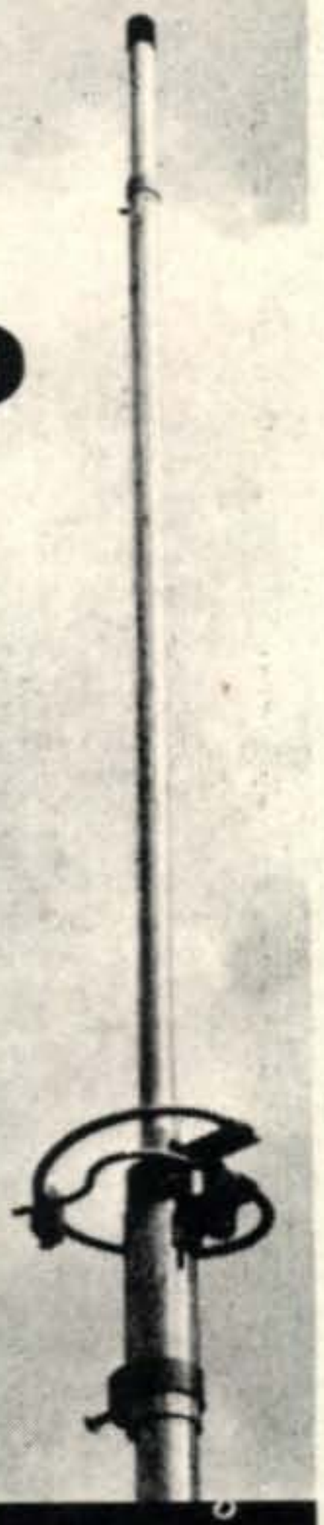

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SELL: Drake TR6, Ser. 165, AC4, MS4, Manual, Mint, Will Ship, WB9AUL, 112 Calif. St., Carterville, IL 62918.

SWAN CYGNET 270, like new, in original carton with manual and AC/DC cords. $335. K4ACJ, 4524 Michigan Ave., Miami Beach, FL 33140.

FOR SALE: New mint WWII telegraph key $5 ppd. Goodman, 5826 S. Western Ave., Chicago, IL 60636.

WANT: Old or antique telegraph eqpt, wireless gear, QST's pre-1930. D. Spence, 10 S. 771 Claren don Hills Rd., Apt 201, Hinsdale, IL 60521.

WANTED: Collins KWM-2A, w516-2. State condx and lowest price. Russell, 19680 Mountville Dr., Maple Hts, OH 44137.

SB-34 on air 3 times $275.00, SB2-Mic $10.00, HW-12A $90.00. All mint. WA9VVI, RR1, Princeton, Ind. 47670.

U Pick-up only. All for $100. FB HQ110, BC342, VFO & Semi-key. EICO 720/730 needs little work Other odds. T.C. Townsend, 97 Parkwood Dr. Kennesaw, GA 30144 (404) 926-3424.

Mech. Filters; 455 kHz. 2.1kHz-$18.95. 300 Hz $22.95. J.A. Fredricks, 314 South 13th Ave. Yakima, Wash. 98902.

CHESS: Would like to contact all radio chess players. K3RCF, Wm. B. Adams, P.O. Box 1747 Hyattsville, MD 20788.

I just bought an old radio repair shop. SASE f list of tubes, vibrators, etc., for sale. James Fred Cutler, Ind. 46920.

SELL: CQ, QST, Radio, R/9, Modern Radio, Audi Eng., text books. SASE to W2SOY, 557 Ceda Ave., W. Long Branch, NJ 07764.

FOR SALE: Heathkit HW-16 xcvr. Brand new, ne er used-$110. WA2ZEZ or 167 Kentwood Blvd Bricktown, NJ 08723.

Heath Twoer, mike, P/S, VTVM, etc. SASE. Jurov Box 183, Olympia Fields, Ill 60461.

ELMAC 67 - 160m thru 10m cond. excellent $40 prepaid. W6ZI, 595 Midway, Novato, CA 9494

Beautiful Building Job on CW xmiter w. ann. swit 40 m coild $20. WN9JTC, 445 Homan Ave., Pa Forest, IL 60466.

BC-221A test set, AC supply, charts - best offe Ten-Tec 80/40 scvr - $30. Vikll vfo built-in 160 converter - $50. Bob Patten, W4OZF.

Galaxy V Mk3, with remote VFO, AC/spkr, F3 C Filter $350 plus shipping. Pollock, Box 215, Iron NJ 07845.

Tektronic 512 Scope. Very good $200. Dumo Scope monitor and camera (TV) $95. WB5BL 3728 Wilkie Way, Ft. Worth, TX 76133.

WANTED: HRO-60 coils & acces. Especially E & crysl. calibr. & NB FM. Good cond-right pri Bondy, P.O. Box 7171, Tampa, FL 33603 (81 233-1901.

Heathkit DX-60B for sale, works like a dream $5 J. Wyncott, WA9WHL, Box 1155, Wiley Hall, P due Univ., W. Lafayette, Ind. 47907.

WANTED - INFO - Gem 2M Converter, Nuvist 6x8 Need to know B+, Also need manual Lettine Model 242, Send letter stating price fo or prefer to borrow one to copy. WM8MEJ, 4 Locust Lane, Troy, OH 45373.

FOR SALE: like new Yaesu FTDx401, FV4 VFO, spkr $400 Collins 75A4 Serial No. 47 excellent cond. $350-W7UR, 12945 SW 135th A Tigard, Ore. 97233 Tel; 503-643-1460.

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JUNK: SWR bridge & meter, alliance rotor unit 6m squalo. $1.00 each as is. No shipping. G. Gargiulo, WA1GFJ, 17 Whitney St., E. Hartford, CT 06118.

SELL: KWM-1 Collins with AC and DC power supply, noise blanker, antennas for car and acces. needed for car operation-$400. K2KKU (914) 668-3534 day; (914) 337-8773 night.

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Collins 32V-1 transmitter $90; Hammarlund HQ 145-X receiver $130; Request Details. H. Severeid, 3602 West 71st St., Indianapolis 46268.

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WANTED: "B" and "C" Band xmit tuners for TRC-24. State condition and price. T.N. Colbert, WA8MLV, 1008 Englewood Dr., Parma, OH 44134

SELL: Pop Elect., QST, CQ, HR, 73 mags 45 cents each includes postage. SASE for list, K2ISX, P.O. Box 26, Springfield, NJ 07081.

WANTED: Assistance in conversion of APX-6, BC-645 and others. Desire only complete info. Will buy if necessary. C.T. Huth, 146 Schonhardt, Tiffin, OH 44883.

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HA460 6 meter txcvr with squallo antenna-excel. cond. $100. TA-31 Dipole (driving ele for TA33 SR) was used indoors-mint cond. $25. WA2RYC.

SELL OR TRADE: 146.34 mHz and 146.64 mHz crystals GE circuits. W7INR/6, 360 Sharry Lane, Santa Maria, CA 93454.

WANTED: 15-10 Dual Band Yagi. Also, 40-10 gap vertical. W7IEX, 1402 W. ALO Way No. 307, Tucson, AR. 85713.

TRADE: Heath HD-10 Keyer and HP400A Decibal Meter for Johnson Match Box 250 Ant tunner. C. Riester, 304 Alpert St., Fort Collins, CO 80521.

FOR SALE: Elements of radio comm. Morecroft Math for radiomen. Cooke. Radio handbook Terman above $4 each. FOB, Douglas, 2254 Pepper Dr., Concord, CA 94520.

Baasemaster II SSB exciter with T21/ARC5 VFO 455; Dow coax relay 115V AC $9. W2DQC, 229 Charles Lane, Pleansantville, NY 10570.

Antique Gear Collectors: Old tubes 200s, 201s, etc. available, SASE for list, WA4NED, Box 468, Gainesville, GA 30501.

FOR SALE: NC-183 receiver, good condx, solid state power supply only mod. $65. K3JYZ (301) 474-7771 after 1900 EST.

FOR SALE: Globe King 400 watt xmtr AM/CW manual. Good condx. $100. Cannot ship. Ashley, Box 254, Ware Shoals, SC 29692.

Canon SFT 600 base/mobile CB xcur-5 chan + ant Cent cond. I ship. Must sell. $85 or best offer. WN2FIG, 5221 Avenue I, Brooklyn, NY 11234.

WANT: Heath Q Multiplier QF-1 and Wilcox CW-3 receiver. Lorenson, Hillsdale, NY 12529.

SELL: Jones MicroMatch MM-1 for use or collector Mint. Johnson LoPass filter. Like new. Harlan Dewitz, Wisner, NB 68791. WØDHO

Will trade excess ham gear for military relics (medals, helmets, swords, uniforms, etc.) W2WLJ, 17 Coleman Rd., Berlin, NJ 08009.

SALE: Cliff Dweller Antenna, HA-14 and AC Supply, Hammarlund Speaker Fr. Miller, WAØILV, Clarkson, NB 68629.

DRUM SET: Ludwig 8 piece drum set-$1000 value, never used. Will swap for SR2000 Hurricane or similiar unit. I pay freight! WA9VLK, 719 West Water St., Kankakee, Ill 60901.

SALE: Johnson Viking Challenger transmitter, 80 thru 6 mtr bands and Johnson T-R switch, both xcel condx with manuals-only $70 for both, plus shipping. WA3FSL (215) 777-9378.

WANTED: Variable Caps. 1KW. sing gang 25-347 pf. Dual Gang 15-196 pf. Bob, WNØGGD, 5107 Red Barn, St. Joseph, MO 64503.

SELL: Western 201 meters-0-15 Ma, 0-150 Ma, 0-200 Ma. $6 each. Will ship. W3SJL, John Guthrie, St. Marys, PA 15857.

FOR SALE: Swan 350 with xtal calib, AC & DC supplies. Good condx. Best offer, you ship. WA1-EUF, 78 Delaware Ave., Manchester, NH 03104.

FOR SALE: Model 26 Teletype machine. In excellent operation condition. $35 but will not crate for shipping. Gresley, R.R. No. 3, Newcastle, Ontario, Canada.

WANTED: Sideband rig for 6 meters transceiver or transmitter. Need not work also grid dip meter. B. Sethman, 92 Allen Plan, Donora, PA 15033.

Atwater Kent model 40 receiver for sale or trade for ham gear. A. Emerald, 8956 Swallow Ave., Fountain Valley, CA 92708.

Tri-Ex H-471 tower, heavy duty 71 footer, for sale or trade. So. CA area only. A. Emerald, 8956 Swallow Ave., Fountain valley, CA 92708.

SB-101 w/ps & speaker for sale or trade. Excel cond Want Alpha 70 linear amp. A. Emerald, 8956 Swallow Ave., Fountain Valley, CA 92708.

QUICK SALE: NCX-500 500w PEP xcvr, $250 or $270 with AC PS. Reply by mail only to ID, Hamilton Hall, Princton U., Princeton, NJ 08540.

WANTED: QST magazine for the years 1916, 1917, 1919, 1920, 1921, and Jan, Feb, March, Nov of 1922. Contact Paul Kluwe, Edmore, Mich 48829.

SELL: 813 PA 1/2kw exc. cond. $50; PP805's mod C1B 400w $50; FRF RATT TU $40. Link 25 OUFS base $100. K8CSG, 4858 Sharon Hill Dr. Worthington, OH 43085.

WANTED: Junked Hammarlund Gear for parts. Need op. switch for HX50A, 15-30 MC coil for HQ180A. WA3EFH, Box 48, Harmony, PA 16037

WANT: Old radios, books, catalogs, handbooks, call books, wireless mags, and parts, before 1930. Erv Rasmussen, 164 Lowell, Redwood City, CA 94062.

HB 1500 W PEP 80-10 Linear-$100. Lorain Labs Camera Shutter timer-$95. Mort Caldwell, W8IFN, 1068 Windsor, Morgantown, W. Va. 26505.

B & K Model 400 CRT tester rejuvenator. Exc cond. with manuals. $12. P. Carron, 205 Ridgewood Rd., Easton, PA 18042.

Motorola T416/GR FM transmitter 45 watts, 25-50 mc. Goop cond. $9.50 PPD., A. LaBella, 1000 Clove Rd., S.I., NY 10301.

Collins 62S-1 Converter used 50 hours w/5 extra final tubes $625 will ship. Earle, 3025 No. Valley View St., Orange, CA 92665. (714) 637-3505.

SALE: Lafayette 11, 10, 6 meter mobile linear amplifier. Make offer-mint cond. WA3RJM, 1180 Ruxton Rd., York, PA 17403.

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WANTED: Tyalor T-200 tube, DeForest spherical "Audion" triode with single or double plate. W9-LGH, 610 Monroe Ave., River Forest, IL 60305.

FOR SALE: Complete amateur station. SASE for detailed list & price. Tom Strohmeyer, 2504 Clarendon Ave. N.W., Canton, OH 44708.

LAST CHANCE: 2 KAAR FM172X xmtrs $20 ea. you pay shipping. W7INR/6, 360 Sharry Lane, Santa Maria, CA 93454

SELL: Vac. Variables with turn heads-UCS300-$25 UCS400-$30, FB turns counter $8, and more. G R. Trammell, 1507 White Oak Ct., Martinsville, VA 24112.

SELL: HQ110, clock, mathing spkr, manual, Johnson Ranger II, PTT MIC, manual. R. Oras, W9XEW 3636 S. 59th Ave., Cicero, IL 60650.

SELL' Complete radio system for construction warehouse, etc. operation. All solid state. Write o call for details. Trammell, 1507 White Oak Dr. Martinsville, VA 24112.

Ham Transformers rewound. Jess Price, W4CLJ Raehn St., Orlando, FL 32806.

Mechanical Filters: 455kHz. 2.1kHz, $18.95. 30 Hz, $22.95. J.A. Fredricks, 314 South 13th Ave Yakima, Wash 98902.

Desperately Need Schematic for Polly-Comm. 6 transceiver. Will Pay. T.M. Hill, Jr., 1851 Cliffhil Dr., Monterey Park, CA 91754, 721-3333.

SELL: SX-140-$45; Mosley CM-1 rcvr-$70; S-38- gen. cov. rcvr-$25, Hy-Gain 400 rotor-$95; Johnso TR-switch-$18, Z-EL Quad-$50; Kojo Delux C filter-$10; Dow Key Ant relay-$10. K1VTM.

Johnson Viking II and VFO. exc. cond. manual LP filter, coax relay, fone patch, etc. $125. A Giambalvo, W2SXX, 1303 Lenape Trail, Mana quan, NJ 08736.

Utica 650 xceiver & vfo. All cords mike & boo $50. Free squalo ant if you pick up. W1UNV

SELL: Ampex F-44 tape deck-$150, Heathkit G 1A mohican SW rcvr & GD-125 Q-multiplier-$5 or will trade. Pick up only. WA9WVJ.

SELL: Drake 2-C, 2-NT Station with cables. 1 month old; First $300 gets it. Postpaid. WA2RO 91 Brendel, Hamburg, NY 14075.

SELL: HQ170C $150, Super Pro SP600 $225 G axy 300 trnscvr, AC PS, 1kw linear $325. WA4K 3084 Green Valley Dr., E. Point, GA 30344.

Collins 32V-1 140 watt AM/CW transmitter-$9 Hammarlund HQ-145-X receiver $130. Request f information. H. Severeid, 3602 West 71st, India apolis 46268.

Pacific Northwest Hams: How about checking in the northwest single sideband net? Meet the ga daily at 0130 GMT on 3945 mHz, rain or shi

National SW-3 Receivers for sale. With coils. Wr for details. Dick Nebel, W2DBQ, 31 Whitehall Bl Garden City, NY 11530.

Base: HW-100, HP-23A, 454X, HO-10, New T 44: $400. Mobile: HW-12, HP-13A, 355C: $15 Both: $500. WA3LMH, 612 Range End Rd Dillsburg, PA 17019.

WANTED: 2 117L7GT Tubes at low cost. WN6SH 996 Lynwood Dr., San Bernardino, CA 92404.

WANTED: Heath watt meter/swr, Cantenna a SB600 spkr. Also 71 call books, T. Coddingt WB6AWC, 7825 Scotts Valley Rd., Lakeport, 95453.

P.C.'s for most construction articles seen in Ha periodicals. Also P.C.'s from your artwork. Wri D.L. McClaren, W8URX, 19721 Maplewood Av Cleveland, OH 44135.

ANTED: Schematic, manual or zerox copy for Utica FMR12 recvr and Motorola H23AAC-1101 AM FM handie-talkie. W8VZ, 520 3rd Marietta, OH 5750.

wan 500-C (factory modified to CX) w/ac. Excel ond. $400. I will ship. S. Gould, 460 Forest Ave., aramus, NJ 07652 (201) 262-8682.

ELL: HT32-A $150, Johnson Thunderbolt Linear 175, HQ170AC $145, Heath SB303 $295, and ore, WA2RJV, Box 2772, Harrisburg, PA 17105.

ELL: HT37 and SX101A both in excellent cond. 295 for both. W2SGA, 284 St. Cloud Ave., W. range, NJ 07052.

ulti-Elmac AF-67, 160-10, w/VFO $35. New static Hi-Z 335H0GS $18. Paul, 3535 Californ- Ave., Pittsburgh, PA 15212.

ELL: CQ's from 45, QST's from 1915, 73 and am Radio as well as call books before 1930. Send t for quotation. Erv Rasmussen, W6YPM, 164 owell, Redwood City, CA 94062.

C12 69A, 145 to 600 MC, 17 tube rec. AM/FM 0, Lafayette 99-2508 SWR meter $10; W2DQC, 9 Sarles Lane, Pleasantville, NY 10570.

echanical Filters: 455kHz for solid state. Excel- nt for SSB. $12.95 w/instr. E. Jeltrup, Box 361, amaroneck, NY 10543.

ANTED: Heath HW-12A, HP-23A, SB-200, SB 0. Need not work. State price & cond. WA4VQD , 243 Fairway Dr., Fairborn, OH 45324.

llins Mobile Power 516E-1 with 351D2 mount d shield. $100 f.o.b. Will ship. W1SO, 275 Brew- r Rd., Bristol, CT 06010.

n selling out personal Calibration lab. Electronic t equip. of all kinds. No list. Write wants or eds. Lowest prices. A.C. Perry, Rt. 1, Box 192E, nks, OR 97106.

ANTED: Vox unit for Galaxy III. Quote price & nd. to K5ENL, Ed Block, Tr. 4, Grandview, TX 050.

R SALE: BABB TAR6 6-meter xmtr & cnvtr. 1 mHz out. $12. Heath XC-2 2-meter cnvtr $20. ZUV, Box 7502, Miami, FL 33155. Prepaid.

LL: Globe Chief 90-A $20, HA800 rcvr with aker and xtal calibrator used three months $85. th for $100. W. Johnson, 728 East St., Opelousas 70570.

LL: HT37, SX117, and SBE34 plus mike. All t condition. No shipping. K82WN.

NTED: SB-110A and HP-23 Heathkit receiver & ver supply. W7JAX, 11639 26th S.W., Seattle, sh. 98146.

LL: Drake TR-4 (Serial No. 23390) $395. Bob n, 105 Hessian Hill Dr., Pennington, NJ 08534.

th Twoer, VTVM, RF gen'r, audio gen'r, etc. SE. Box 183, Olympia Field, IL 60461.

DIO magazines, books, catalogs, bough sold & led. Donald R. Ryan, Star Route Box 301A, S. mouth, NY 13844.

NTED: Ham Band walkie-talkie (not sm fm) 5ZWS, 5113 Arvada St., Torrance, CA 90503.

117 $200, HT-44 $190, PS-150/120 $60, NC- $200, DC supply $60. Ted Melinosky, Fred- Rd., Vernon, CT 06066.

R SALE: KWS-1 1547, cables, manual, SC-101 sole, $800. 75A4 5831, 0.5, 3.1, 6.0 filters, ual, $525. J.W. Craig, 29 Sherburne Ave., Ports- th, NH 03801.

ssener Signal Shifter 80-6M w/manual 10W .50, Twoer w/manual $25, TG-34 w/tapes ??? 4TJJ, 5204 Penelope, Knoxville, TN 37918.

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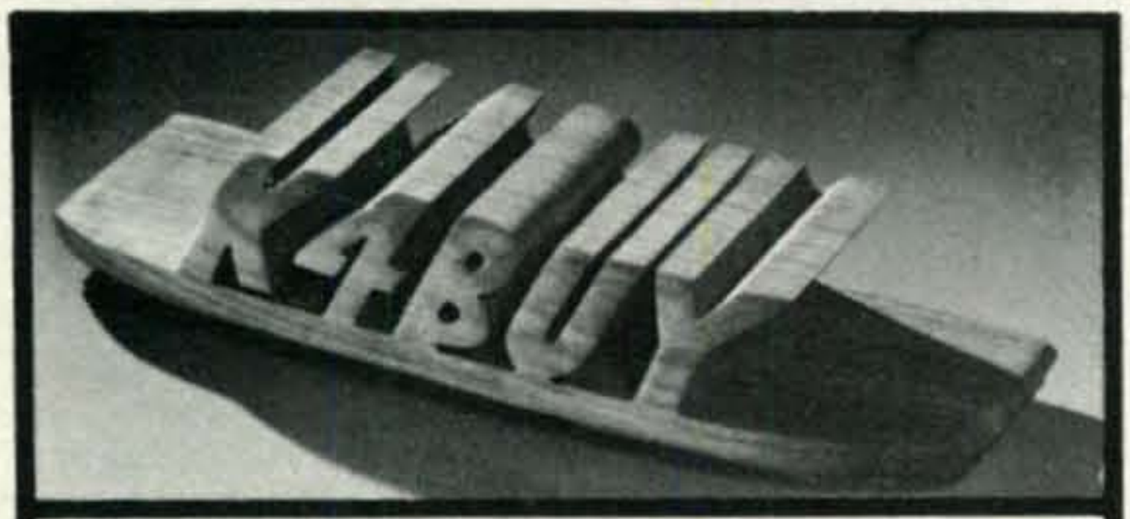

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WANTED: TR-6 Drake, Halli. HA-2 + P-26 AC, Drake TC-2, TC-6 + SC-2, SC-6 conv. Clem-K8 HWW 33727 Brownlea, Sterling Heights, MI 48077.

160m-Viking II/built in 160m rcvg. converter $50 Ten-Tec 80/40m 2w transceiver $30. BC-221-AA freq meter. Heath SB-101 in good condition with manual W4OZF.

Gladding 25 2MFM, with matching AC/PS, 11 crystals, manual, like new $285.00. Gerald Manning, K4WWL, 326 S. Hamilton St., Dalton, GA 30720.

FOR SALE: Complete Amateur Station. SASE for detailed list & price, Tom Strohmeyer, 2504 Clarendon Ave., N.W., Canton, OH 44708.

F.M. Gonset G-151A xceiver 12V/100V perfect $95, BC221 w/book $25, G.E. 150 mc FM xceiver $15, want 45 Auto K6KZT, 4434 Josie Ave., Lakewood, CA 90713.

SALE: Tow Jan813 tubes, two RCA 809 tubes, good condition, make offer. W6DOU, 3154 Stony Point Rd., Santa Rosa, CA 95401.

Lafayette HA-460 6M xcvr, Manual, Excellent condx. $65. I pay shipping. WB2IQF/Ø, P.O. Box 432, Evergreen, CO 80439.

WANTED: Big filter capacitors & vacuum variables. John W. Williams, P.O. Box 186, Greenville, SC 29602.

FOR SALE: Johnson Viking "Challenger" (120w C.W./AM xmtr) and Hallicrafters "SX-99" receiver. Both $90. K2SEB (201) 265-2825.

WANT: Old call books, QSL, M. Hoshiko, 707 S. James, Carbondale, IL 62901.

WANTED: KW amplifier's for 220 & 432MHZ. Hygain or Telrex 15EL YAFIS for 144 & 220. Write K8HWW.

ELMAC AF-67 trans-CW-AM-FM, M-1070 AC-DC P.S., Spkr. $100. W6DJZ, 3748 Floresta Way, L.A. CA 90043 (213) 294-0284.

SELL: Johnson Thunderbolt 2KW Linear-$175, HQ170 receiver $145, HT32-A transmitter, needs x'fmr $70. WA2RJV/3, Box 2775, Harrisburg, PA 17105.

FOR SALE: Poly-Comm 6-2B transceiver (AM) good cond. $150. WA2PLU, 9 Nancy Lane, Larchmont, NY 10538 (914)-834-4497.

Collins Mechanical Filters for 75A4: 500, 2100, 3100, 6000 Hertz. $35. each, postpaid. Money order only! But write me first. B.Berk, 5218 Prescott, Lincoln, NB 68506.

WANTED: National NC-190, NC-140, or NC-121 recvr. in good condx w/manual. L.F. Fultz, 110 High St., Pomeroy, OH 45769. Days 614-992-5100

Drake AC3 Power Supply $65 money order only. You pay ship and insurance charges, write me first! B. Berk, 5218 Prescott, Lincoln, NB 68506.

Conical Monopole all band antenna Collins 237 W1X Originally $7200 Now $350 or trade. WAØEMS Box 11, Liberty, MO 64068 (816) 454-3213.

8 to 9 MC crystals in FT243 holders, large stock many on same freq for netoperation. SASE fo listing, $1 each. W1DL, J.M. Hoffer, 24 Cherry Rd. Framingham, MA 01701 (617) 872-5084.

FOR SALE: HW12A with manual and cable to PS very few hours on air-$110. F.O.B. your shack WA3FSL (215) 777-9378.

Look for the Ohil Valley Teenage Net on 3965 Daily. WB8EEZ, Net. Manager.

SELL: KWM2A, $700, 312B5, $350, CPI with 7(crystals $225, CC2 carrying case $50. Drake DC3 $85. WA3IFG, Box 11235, 1138 Boxwood Rd. Jenkintown, PA 19046.

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WANTED: VOF550, have XO 550 will trade or sell Also have 7" reels magnetic tape. Send price & cond. SASE, WA7NUZ, P.O. Box "D", Springfield, OR 97477.

WANTED: Magnetostrictive transducer, 20Kc resonant freq., for homebrew ultrasonic cleaner. WB2FKA, 28 Bridlemere Ave., Interlaken, NJ 07712.

WANTED: 2 meter FM equipment. Will trade Wyo. ranch land. K6ICS, Mike Gauthier, 9418 Florence Ave., Downey, CA 90240. 213/923-0131.

Motorola Diodes MR1130 (1Kv, 12A) Have 6. orig. cost $47.20. All for $15. Adinolf, 5113 Arvada, Torrance, CA 90503.

WANT: Old or antique telegraph gear, ticker tape machine, QST's. D. Spence, 10 S. 771 Clarendon Hills Rd., Hinsdale, IL 60521.

SELL OR SWAP: CV-591A SSB converter's used on SP-600, R-390 etc. Make Offer. Duval, 33727 Brownlea, Sterling Hgts., MI 49077.

WANTED: Schematic Diagram or instruction book for the old Globe Scout Transmitter. W7JI, 235 E. 15 St., Tempe, Ariz. 85281.

WANTED: Noise Blanker for Swan 250-C. Either N.S. No. 1, Westcon or equal. WAØKKC, 7139 Hardy, Overland Park, Kansas 66204.

WANTED: 2 or 3 element Triband beam. State price and cond. John Brewer, Box 724, Jacksonville, AR 72076.

East Bay (SF). Mt Diablo ARC meets 8 PM 3rd Fri. of Month (Except Dec.) at Red Cross Bldg. 1301 Ygnatio Valley Rd., Walnut Creek, CA

Mint, Drake TR6 w/Ms4 and PS. Full xtals. Factory aligned in June 72. $550. WB5CWB, 2624 S.W 59, Oklahoma City, OK 73159.

SWAP: NCX-C-'DC' power supply, Heath AC power supply, Nearly new NCX-3 (20 hours use) for HR-2A. WB5BLX, 3728 Wilkie Way, Ft. Worth, TX 76133.

BC-453 "Q" Fiver unconverted $15. HRO dial and gear train. $10. Dow co-ax relay 440 ohm $8. W6BLZ, 528 Colima St., La Jolla, CA 92037.

TRADE: 8 MM Movie outfit, mint, for new or mint SB 220, all replies answered. WAØGYX, George, 1422 So. Pearl, Independence, MO 64055.

Motorola P-33 BAM 5 watt fm with Nicads, ant, extra xtals, manual A-1 $100 Wm. Sakal, 62 Bacon Hill Rd., Pleasantville, NY 10570. 914-769-0866.

WANT: The radio boys on the Mexican border, by Breckenridge. K6ARE, R. W. Randall, 1263 Lakehurst Rd., Livermore, CA 94550.

WR xfmrs, chokes, tubes, xtals, nicads, relays, coax, cabinets, chassis, connectors-state needs-SASE list-WB2FKA, 28 Bridlemere Ave., Interlaken, NJ 07712.

Will buy your Collins gear if price is right. W4AIS, 100 Thornwood Dr., Taylors, SC 29687.

WANTED: Instruction Manual (s) for NC-57 & Globe Chief Deluxe xmtr. Will copy & return. WN8-IJI, Kevin, 6068 Horizon Hts., Kalamazoo, MI 49009.

Just Sell: Ten-Tec PM-2 portable CW transceiver, shipping in original carton. $30. Hubert Holmes, WN4ZXG, 2129 N.E. 62 Ct., Ft. Laud, FL 33308. 305/772-9322.

500 Central Electronics Transmitter mint condx. $350. WA2BBU, Jack Rudbart, 21 Ravona St., Clifton, NJ

SELL: BC-610H; excellent condx, 2 sets of coils & VFOs $375 FOB. Globe King 500A, excellent, includes mike, $275 FOB. K8CCV.

Antenna bugs/engineers: buy valuable IEEE transaction on Antennas & Propagation; 27 issues of 1965-70 only $1, K2AHZ, 5 Shasta Pass, Fanwood, NJ 07023.

WANTED: Old table-top radios, vintage 1920-1930 and phonographs. Joseph Schwartz, 43-34 Union St., Flushing, NY 11355.

FOR SALE: Heath SBA-300-3 6 mtr conv $18. Vanguard model 201 preamp for 50 mHz. $19 PPD. Dave Kosh, K3YVN, 412-462-3496. Write or call.

SX-100 rcvr $150. HT-18 VFO, to drive SB-10 $20 SB-10 $50. 200w linear $60. Keyer $20. Write for full details, K9YRA.

WANTED: Collins 32S-1 and/or 516F-2 in any cond. Sell: TA-33 and Hy-Gain 15 meter beam. M. Ludkiewicz, 143 Richmond Rd., Ludlow, MA 01056.

Canadians: Sell FTDX 100 xcvr mint condx-18AVT /WB vert. Armaco MR4 mike. VE2QG, 7 Vesboir, Riviere-du-loup, Quebec, Canada.

Need: 40m CW sked w/NH, ME, SD, Alaska, Mont, Wyo, SC, Del, LA, Minn. K5MHG/6, 419 West-Bourne, L.A., CA 90048.

Teletype 19, $140. Electrocom FSC250 freq. shift converter with Electrocom TK100 tone keyer, $150 Panoramic Panadaptor PR1, $80. More. W1SUQ.

Hammarlund HQ170 AC excellent condition $180. Free delivery 200 miles. W5EGG.

Brand new Drake RV-4 VFO $90. PPD. Drake 100 L.P. filter $4. P. Feely, 15 Locust Hill, Yonkers, NY 10701.

WANTED: Coil sets No. 18-2915-1775 to 2050Kc. and No. 18-2918-14000 to 14400Kc. W8FWQ, 52-15th St., Port Huron, MI 48060.

FOR SALE: Much Modified Viking Valiant 400 Watts CW only - Modified schematic provided $80. K3S4Z, 301-380-7771 after 0001 GMT.

RTTY Picture Tapes Sell or Swap. Five or eight level. Send stamp for list. K2AGI, 5 Hansell, Murray Hill, NJ 07974.

WANTED: ARC-5 rcvr & xmtr, working or not, all chassis intact: pay $5.00 ea. Also old radio books & ham magazines. Jim Gunn, WN1QNK, Ossipee, NH 03864.

BC-342 xclnt 1.5-18 mHz rcvr with manual and matching LS-3 spkr. AC pwr. $75. Silbert, Wh. Sulphur Springs, NY 12787.

SALE: New tronics Cliff Dweller, Hammerlund Speaker, HW-12, HA-14 & AC sup. F. Miller, Clarkson, NB 68629.

Send 25 cents for credit and list of surplus FM commercial and amateur gear. J.E. Hiatt, c/o Georgia Two-Way Inc., 600 Armstrong St., Marietta, GA 30060.

MILLEN 90651 Grid Dip Meter, excellent, $70. 12 UF 1000 VDC oil caps, $2.00. WB4AJZ, P.O. Box 3074, Bristol, TN 37620.

SELL: Eico 369 Sweep Generator, exc. $45.00. Weston No. 301 0-200 Microamp panel meters. $3.00. SASE for my listing. Samkofsky, 4803 Brenda Dr., Orlando, FL 32806.

Johnson Viking 500 with SSB adapter. Good condition $400.00 No shipping. W1JTS, 13 Trask Rd., Peabody, MA 01960.

SELL: SBE-34 mike, mobile mount $200. SB-300 $175. WA1PJO - 413/442-3880.

FOR SALE: Johnson Low-Pass Filter-$10. Allied low-band police monitor-new condx-$15-novice station-WB8IMG, 140 Paw Paw Lake Dr., Chagrin Falls, OH 44022.

FOR SALE: NCX500 with AC supply $225. Factory reconditioned. 5 bands, 500 watts, SSB/CW. Tom Dornback, 2515 College Road, Downers Grove, IL 60515.

SELL: Heath VHF-FM monitor receiver, AC power supply, crystals-146.94, 155.01. Postpaid $50. G. A. Baldauf, 175 Wernersville Blvd., Wernersville, PA 19565.

WANTED: Crypto equipment. e.g. M-134 cipher machine, etc. Also crypto books esp. U.S. Signal Corps. David Kruh, 17 Alfred Rd. W., Merrick, NY 11566.

WANTED: Xmtr 3500-0-3500 at 1 amp or better, 220 Pri. or complete supply. Prefer within 100 miles for pick up. Knowles, 9 Brown St., N. Billerica, MA 01862.

TRADE: Winchester Model 12 pump, 12 ga. Trap Grade-for Henry 2K or SB401-301. 9503 Primrose Lane, Shreveport, LA 71108.

WANTED: Johnson Navigator or Collins 310-B. Chuck Adams, Box 1614 College Station, TX 77840. K5FJZ.

TRADE: SB-301-401 even up for FT-101 area..on air demo. R.L. Stedman, 409 West 12th, Mitchell, S. Dak. 57301.

WANTED: Heath AT-1 Transmitter. Must be in mint condition and operating. W8TXX, Box 111, Benton Harbor, MI 49022.

Will Buy late Drake TR-4 with fact. installed NB, with or without AC/DC supplies. WA5RDQ, 5525 JFK Blvd., No. Little Rock, Ark. 72116.

HW22A, HP13A, Hustler Resonator $135.00 IB 101 freq. counter $160.00. Spaulding 40ft. tower $80.00. W2WHK, 210 Utica St., Tohawahda, NY 14150.

SWAP Ten-Tec PM2B for clean communications revr. w/80-10 mtr coverage, or ham revr. WN2SPA, 1620 E. Thurston, Olympia, WA 98506 SASE pls.

WANTED: Push buttons, knobs for Crosley 02CA. Sell old books, mags, parts, tubes. W9FOC, 1616 Campbell, Joliet, IL 60435.

WANTED: Viking 6N2 VFO, 432 MC Converter, 432 MC xmtr, and the following tubes, 572B, 829B, 813, 100TH, 6146B, 250TH. Lebow, 351 Mower Rd., Pinckney, MI 48169.

Lafayette Net 002 Ten meter xcver. AC, DC, cables spotless. $210.00. Lafayette HA460 like new (6 meter scver) $75.00. SASE gets list. Colella, 105-18 131st St., Richmond Hill, NY 11419.

FOR SALE: DX 100 excellent condx. No shipment $50.4 Parkway Court Circle, Allentown, PA 18104

NEED: Collins MP-1 DC supply. Will trade. Heath HW-12 with HP-13. T. Ross, K9GTQ, Rt. 1, Box 137-A1, Irma, WI 54442.

WANTED: 390-A Receivers, will pay cash. Receiver must be New Condition and Collins only. W4AIS, 300 Thornwood Dr., Taylors, SC 29687.

WILL TRADE Hallicrafters SR-46A; Lafayette 750 six meter; GSB 2 SSB Communicator, Want 2 meter F.M. equipment or what have you. WA5TDC, 2925 Del Monte Ave., Bay City, TX 77414.

CQ-QST-Ham Radio Backnumber Magazines 60 cents each $6.00 per year, postpaid. Send SASE for list. A.B. Johnson, 29 Boone St., Bethpage, NY 11714.

WANTED: EIMAC diffusion pump type HV-1 for Ham amateur museum, W9LGH 610 Monroe Ave., River Forest, Ill 60305.

Linear Amplifier-2 meter Hammarlund 500B. 10 watt input, 150 watt output. 110vac p.s. built in. $130. 2E, 1301 Estes, Chicago, IL 60626.

SELL: Xfmers 3600-0-3600 a Amp $25, 1.7 Amp $40, with 100/200 primaries & FOB. Want: Used Telrex 40, 20, 15 meter beams. Paul Bittner, 814 4th St. S,Virginia, MN 55792.

ATTENTION! Ham with extra mechanical SSB filter for 75S3-B wishes to meet ham with extra CW filter for 75S3-B. WA2WXJ, 49 Hollywood Ave., Massapequa, NY 11758.

SELL: NC-300 160-2m. rcvr w6 +2 conv. spkr exc. $175. SX-100 gen. coverage $125, GSB-100 SSB trans. $75. WA2TAT, 38 College Lane, Westbury, NY 11590.

New Pair Wood-Brooks Reg. Pwr. Supply 12-24v 5 +A, ea $25; New paid Stancor Trans., small, $12 ea. Cleaning shack VHF gear List SASE. W4API, Box 4095, Arlington, VA 22204.

SELL: HQ129-$75; Panadaptor PR-1-$50; Scott All Wave Rx Model SLR-H-$50. W.E. Cann, P.O. Box 264, Hampton Beach, NH 03842.

SELL: Hy-Gain 204BA, like new condx-$95. Will deliver within 100 miles DX60-$50. W8CUT, 1776 Walnut St., Coshocton, OH 43812.

WANTED: QTH near Andrews AFB-Capt. Kessler, c/o W2BSU.

SELL: Yaesu FR-DX-400 Rcvr new condx-$200, fac. sealed recond Collins 136-B2 Noise Blanker-$75 or trade for 2m FM rig. R. Lemon, 316 Mulheim Ft ORD, CA 93941.

Heath Counter, Scaler. Motorola T43GGV, Johnson Viking II for rack mount, other goodies available Write WA4CMC.

Drake 2B, 2BQ, w/cal. Valian (CW only), w/ant. relay. All manuals. All $250. You pick up. WA2PPV 4 The Loch, Rockville Centre, NY 11570.

FREE: List of ham gear (commc. & surplus) for sale-swap? xmttra, rcvrs, cnvtrs, ant. etc. HF0 VHF SASE: WA2WYH, 2366 E. 23 St., B'klyn, NY 11229.

FOR SALE: CE-10B, 3" refractor telescope, test equipment-want 1930 MI plate (car), J. Wagner 950 Sue Dr., Caro, MI 48723.

WANTED: Heath SB500 2 mtr xvtr, give condx & price. WA5ZUH, Rt. 1, Box 58, Lonewolf, OK 73655.

ARIZ. PHOENIX VHF RADIO CLUB 1st & 3rd Wed 8PM, 1510 E. Flower (Red Cross Bldg) Visitors Welcome.

ARIZ. THUNDERBIRD CHAPTER 10/10 Net every Monday starting 9/11/72, 29MHZ (AM) 28.770 (SSB) 7PM Local Time.

FOR SALE: RCA CMC60B FM xcvr 146MC w schem & .34-.94 xtls $70.00, HW32 xcvr $35.00 Heath UT-1 pwr sply $15.00, 4BTV vertical ant New $30.00. Dennis Grahs, WB9EZS, 401 S. Bastow St., EauClairo, WI 54701.

28 Teletype Reperforator Ribbon Drives and Bas Intermediate Gears for sale or trade. D.C. Harrington, 1620 Gardena Ave., Fridley, Minn. 55342.

WANTED: SB110 with OK LMO and manual. Als HP-23. Send condition/price to K5MAT, 35 San Juan, Los Alamos, NM 87544.

EICO 324 sig gen-$20. B&K 400 CRT tester-$12 Both perfect w/manuals. P. Carron, 205 Ridgewood Rd., Easton, PA 18042.

WANTED: Manual and/or Schematic for Morro Receiver model CM-1 buy or borrow. WA6AHI 17494 Via Alamitos, San Lorenzo, CA 94580.

Did you know that new supplements to the book "CQ YL," are now available? They bring the book up to date with YLRL Officers through 1973 and the 6th YLRL Convention, held at Long Beach May '72. If you have a copy of "CQ YL" and would like to add the new supplements (the pages are "slotted" so they fit directly into the "CQ YL" spiral backbone), drop a note with your request to author/publisher, W5RZJ, Louisa Sando, 4417 11th St., NW, Albuquerque, NM 87107. Please enclose two 8 cent stamps to cover cost of mailing. The one and only book about YLs in ham radio, "CQ YL," contains 21 chapters, over 600 photographs. Order your autographed copy, or a gift copy, from W5RZJ, $3.00 postpaid.

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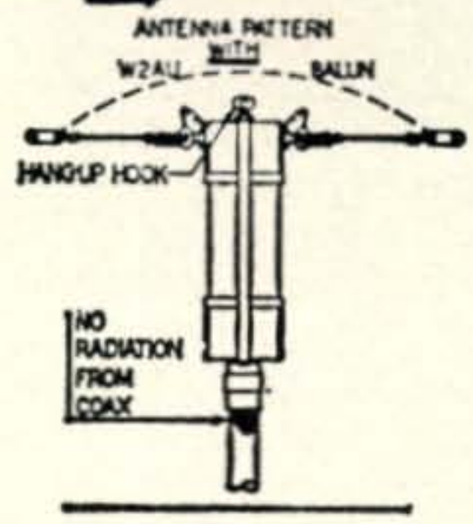

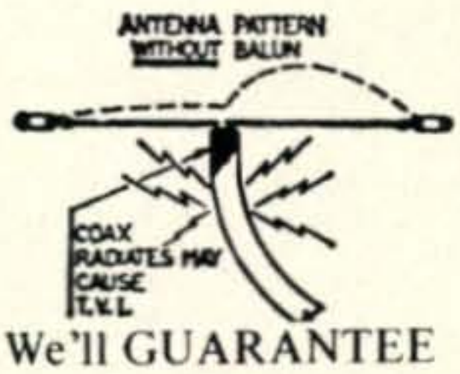

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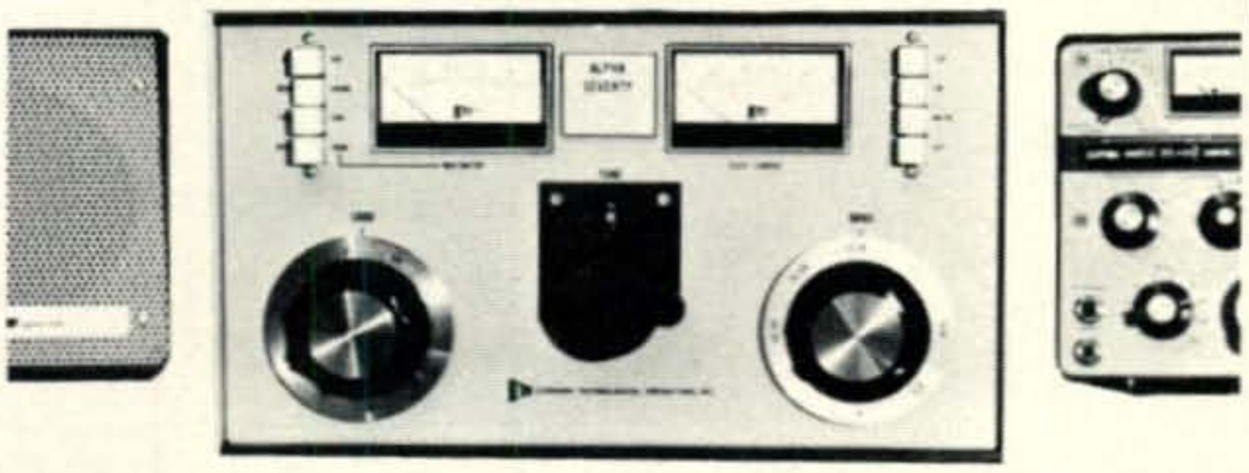

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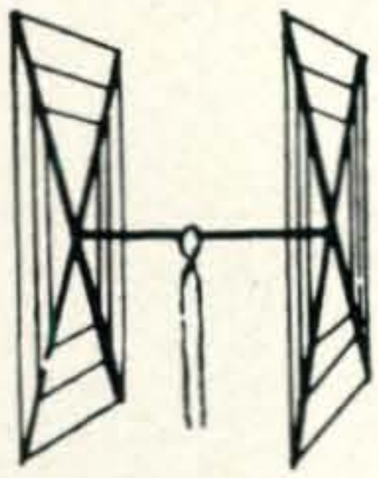
WHICH ANTENNA WINS THE CONTEST ?

In open competition against thousands of commercial and home-brew antennas, WA1JFG won the New England championship with a Gotham beam, by a margin of 5,982 points! WB2JAM won the sectional award for the Sweepstake contest in 1969 and 1970 with a Gotham 4-element 15 meter beam! Hundreds of unsolicited testimonials from grateful hams are our proof that Gotham antennas give you the best design, and the best materials. Forget our low prices - rely on the results of open, competitive contests. Ask yourself: Why do Gotham antennas win?

QUADS

Worked 42 countries in two weeks with my Gotham Quad and only 75 watts...



W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.: 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064" diameter.

X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished); 52 ohm coaxial cable

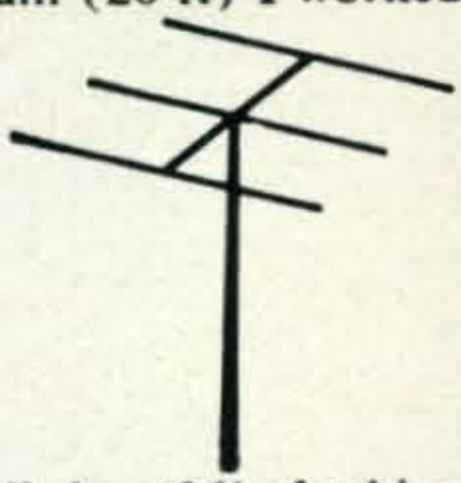
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$41.00
10-15 CUBICAL QUAD	36.00
15-20 CUBICAL QUAD	38.00
TWENTY METER CUBICAL QUAD	31.00
FIFTEEN METER CUBICAL QUAD	30.00
TEN METER CUBICAL QUAD	29.00

(all use single coax feedline)

BEAMS

The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

2 EL 20	$25	4 EL 10	24
3 EL 20	31*	7 EL 10	38*
4 EL 20	38*	4 EL 6	24
2 EL 15	21	8 EL 6	34*
3 EL 15	25	12 EL 2	31*
4 EL 15	31*	*20' Boom	
5 EL 15	34*		

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts!
FLASH! Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$18.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$20.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$22.95

GOTHAM
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For in-car operation, there's a built-in noise blanker — to pick out noise spikes, leaving behind only clean signal copy.

About those plug-in modules — if one of them ever should give you trouble, just send it in to us and we'll rush you a new card by return mail. The Yaesu FT-101 is guaranteed fully for one year.

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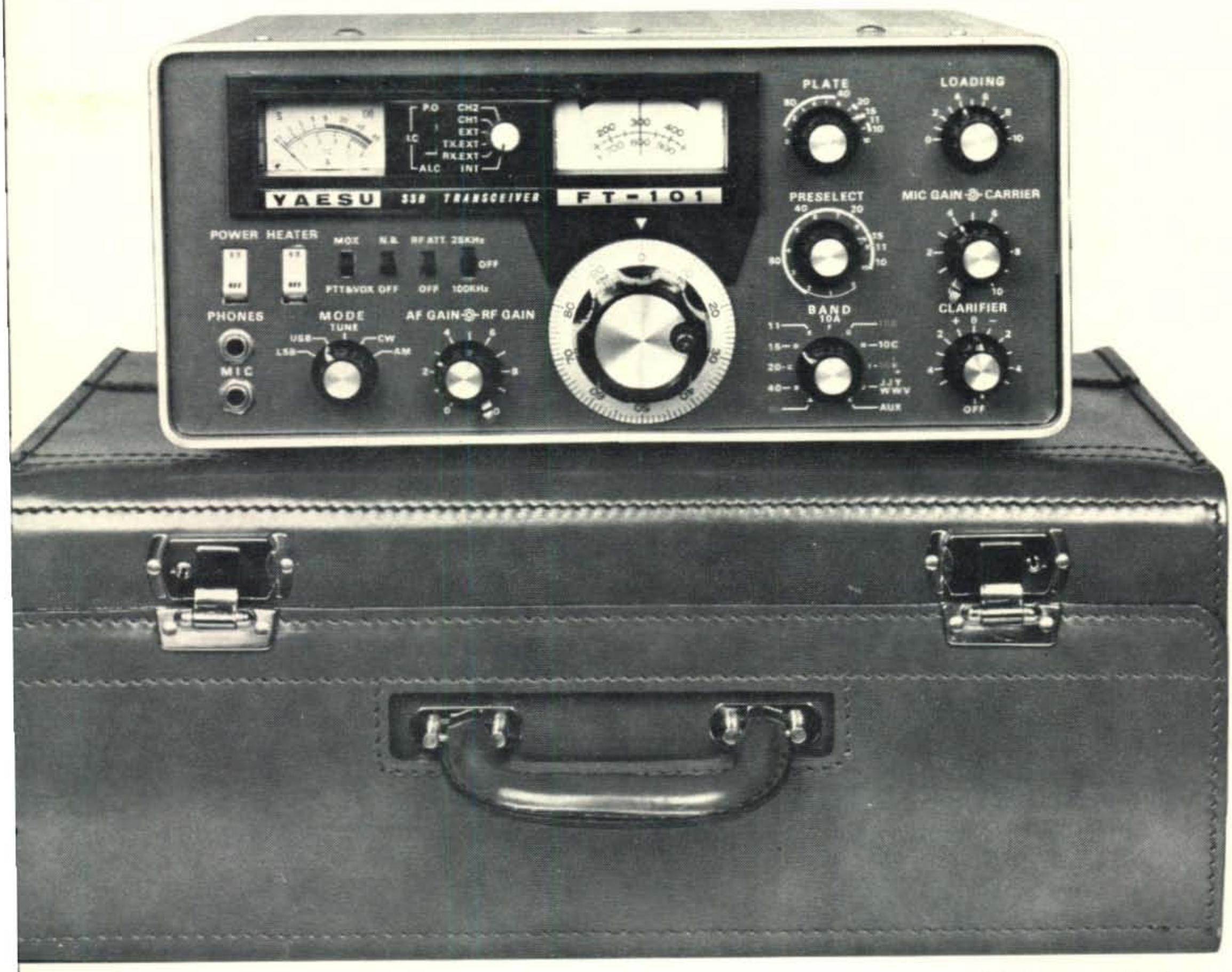


*Suitcase not included

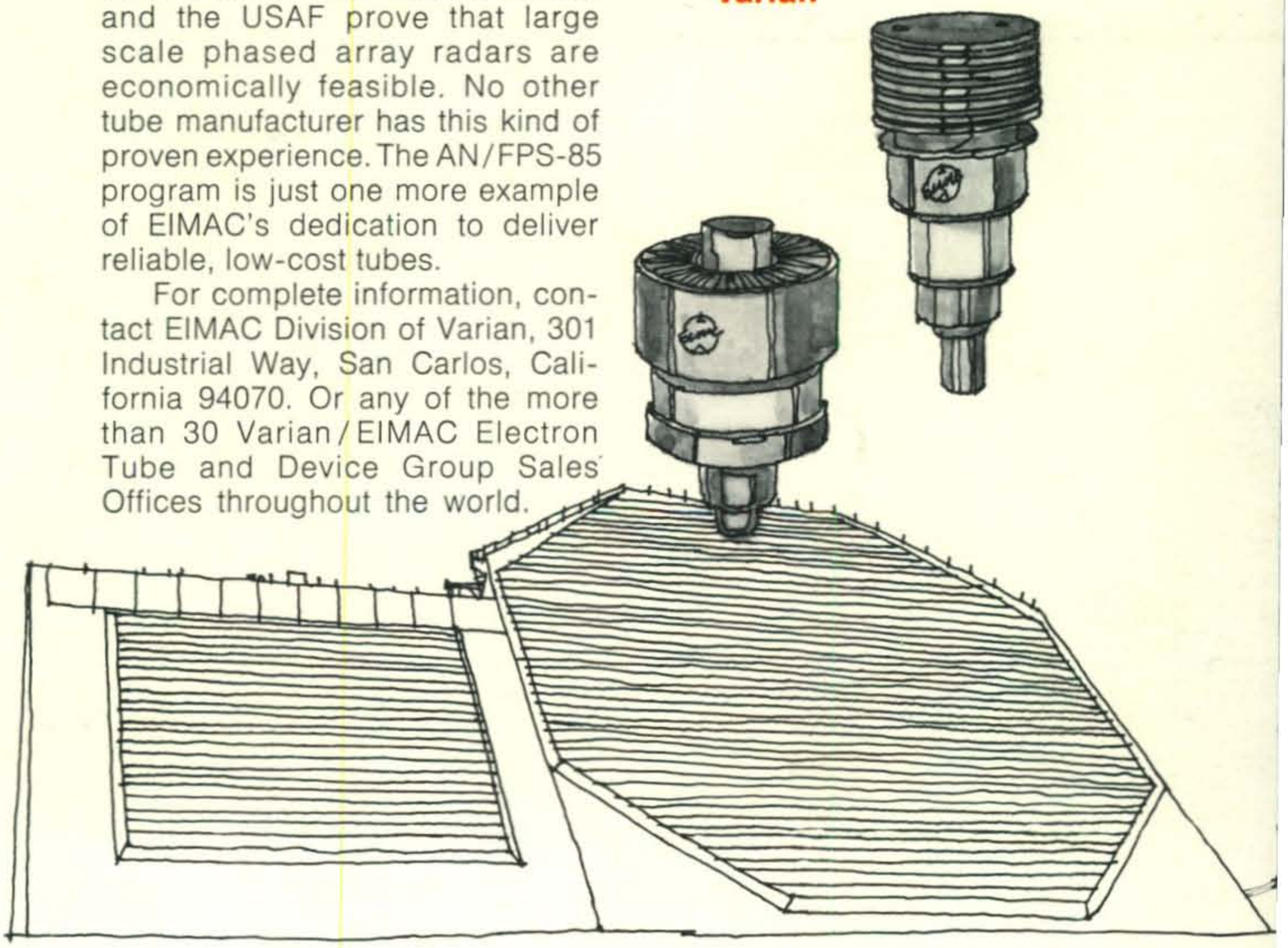
15,552 EIMAC tube types power the giant AN/FPS-85 phased array radar. The cost per tube operating hour is less than 3/10¢.

Bendix chose EIMAC tubes for the AN/FPS-85 phased array radar for two reasons: low cost and long life. Five years of successful operation in the world's largest operational, long-range, phased array radar have proven the wisdom of their choice. They've also learned that complex systems using quality vacuum tubes are easy to maintain and rather forgiving as to voltage and power transients. "Cockpit" difficulties, when they occur, are usually not costly or catastrophic to the tubes.

In the UHF output stage of this system, 5,184 EIMAC 4CPX250K tetrodes each deliver 10 kW peak power output and typically 18,000 hours of life at the bargain basement price of $35 per tube. With this quantity of pulsed operating devices, reliability and low failure rates are *important*

10,368 EIMAC type 8745 planar triodes are used in the driver stages of the AN/FPS-85, providing upwards of 14,000 hours of average life at a cost of only $14 per tube.

The long life and low cost of EIMAC tubes have helped Bendix and the USAF prove that large scale phased array radars are economically feasible. No other tube manufacturer has this kind of proven experience. The AN/FPS-85 program is just one more example of EIMAC's dedication to deliver reliable, low-cost tubes.

For complete information, contact EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070. Or any of the more than 30 Varian/EIMAC Electron Tube and Device Group Sales Offices throughout the world.

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